DIRECTOR OF INDUSTRIES
LIBRARY
4-SEP 1923
BENGAL

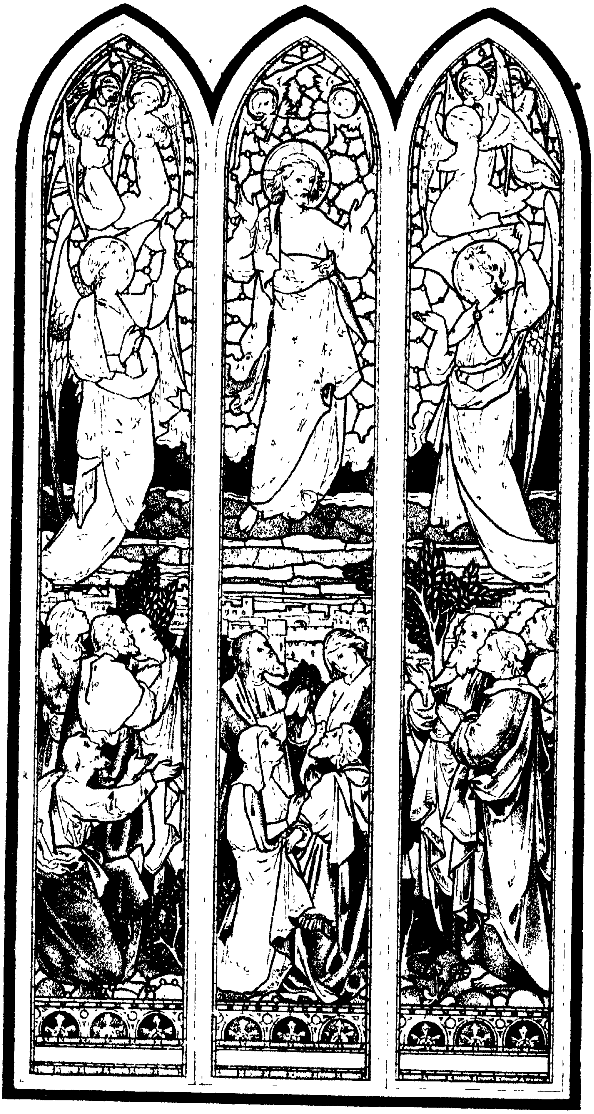
A TREATISE

ON THE

ART OF GLASS PAINTING

THE ABERDEEN UNIVERSITY PRESS LIMITED

ART OF GLASS PAINTING FRONTISPIECE



A WINDOW IN METHLEY CHURCH YORKS

A TREATISE

ON THE

ART OF GLASS PAINTING

PREFACED WITH A REVIEW OF ANCIENT GLASS

BY

ERNEST R. SUFFLING

STAINED GLASS ARTIST

WITH TWO COLOURED PLATES AND THIRTY-SIX ILLUSTRATIONS

LONDON
SCOTT, GREENWOOD & SON
"THE POTTERY GAZETTE" OFFICES
8 BROADWAY, LUDGATE HILL, E.C.

CANADA THE COPP CLARK CO., LTD., TORONTO
UNITED STATES D. VAN NOSTRAND CO., NEW YORK
1902

[*All rights remain with Scott, Greenwood & Son*]

DIRECTOR OF INDUSTRIES
LIBRARY.
4-SEP 1923
BENGAL.

PREFACE.

In writing the following pages the author has had two very different persons in mind: the general reader and the glass painter. The general reader, with an antiquarian turn of mind, may find something to interest him in the first part of the book, which is a short review or history of glass painting; but beyond that he need scarcely venture, as the remainder of the book is of a technical nature, and will interest only the delver into the arts and mysteries of glass painting.

The writer has commenced at the very birth of a window, by showing how the design is made, then in due order the manner of drawing the cartoons, cutting the glass, painting it, glazing it, and so on, till the very last process of cementing is reached.

As few technical terms as possible have been used in explaining the arts and mysteries of producing a stained glass window, which mysteries, after all, are the common-sense use of one's faculties, combined with observation, forethought and patience.

ERNEST R. SUFFLING.

London, *February*, 1902.

TABLE OF CONTENTS.

PAGE

Preface v

CHAPTER I.

A Short History of Stained Glass 1

CHAPTER II.

Designing Scale Drawings 33

CHAPTER III.

Cartoons and the Outline 46

CHAPTER IV.

The Various Kinds of Glass-cutting for Windows . . 62

CHAPTER V.

The Colours and Brushes Used in Glass Painting . . 81

CHAPTER VI.

Painting on Glass—Dispersed Patterns 93

CHAPTER VII.

Diapered Patterns—Aciding—Firing 117

CHAPTER VIII.

Fret Lead Glazing 126

A Short History OF STAINED GLASS.

CHAPTER I.

As to when glass itself was discovered there appears to be much diversity of opinion. The Chinese claim to have used white glass of a very superior quality upwards of 2,000 years before the Christian era; and, if we are to believe the report that glass was then used by them in their astronomical instruments, we may be quite sure the glass was of excellent quality or it would have been practically worthless for that important purpose.

Whether or no the Chinese made lenses of glass may be somewhat uncertain, but we know for a fact that the Egyptians made glass beads and jewels no less than 5,000 years ago. These jewels were of many colours—colours incorporated into the material itself; in other words, they were stained glass. Stained glass truly, but not stained glass windows.

Coming nearer the time of Christ's birth, we know that the Greeks made glass in imitation of onyx, agate, and some of the rarer kinds of marble; whilst the Romans also discovered a way of making a dark coloured glass which they coated with paler glass for the purpose of cutting cameos. Here was the first idea of the more modern "flashed" glass. Then came glass for vessels of various patterns, shapes, colours and uses, and also very beautiful glass mosaic for wall decoration, but no glass for windows.

The Romans were at an early date in the habit of setting small panes of glass in bronze, copper, and even leaden frames, but whether they were for the purpose of mirrors does not appear to be very certain, as the specimens extant do not contain a vestige of silvering or other plating that might have made these mounted glasses useful as *speculi* (looking-glasses).

St. Jerome and others of the earlier Fathers allude to painted glass, but probably these references concern certain medallions of glass which have been found in Greek excavations, having figures painted upon them certainly, but not fired in.

The first coloured glass windows of which there is any record were those in St. Sophia's, Constantinople. These were doubtless pieces of coloured glass set in heavy leads, and appertaining to the same class of work as the mosaics used for mural decoration in the same edifice. This was in the sixth century.

About the same time similar windows were made for the basilica of St. John Lateran and St. Peter's at Rome. From Rome the art seems to have come westward to Marseilles, and from thence northward to Paris, for it is on record that in the year 709 Wilfrid, Bishop of York, invited workmen from the North of France: "Artifices lapidarum et vitrearum fenestratum primus in Angliam ascivit".

Early writers appear to have claimed the invention of stained glass windows for their respective countries in a somewhat puzzling manner; thus the Byzantines made the

St. Sophia windows in the sixth century, although French writers claim the invention. The French taught the English, and the latter the Germans at a period when the art had been already known in Italy for generations ; and we have it on record that an Italian wrote upon the art before the close of the eighth century.

Some of the earliest and most perfect examples of glass windows are still in existence, after a life of upwards of 900 years, in the ancient monastery of Tegernsee, in Augsburg, Bavaria. They were placed in the building about A.D. 980. They are, like all early windows, fragments of coloured glass leaded in the manner of mosaics. Probably there were painted windows 150 years before this period, but none of them exist at the present time.

There is a record of the chapel of the Benedictine Monastery at Monte-Cassino being entirely filled with painted windows in 1066 — the year which saw the Norman hosts conquer our country.

One of the earliest glass painters—a monk of the tenth century—has left quite a long treatise on glass painting, "Diversarum artium schedula Theopholi". From this early practitioner it would appear that the cartoons were drawn upon a board well coated with chalk, the figures being roughly drawn with strips of lead. He gives full particulars of the colours and their component parts, recommending that they should be ground either in wine or urine. The brushes for laying on the pigments were to be made of the hair from the tail of a marten, ermine or squirrel, but if they could not be obtained, a cat's tail or an ass's mane was to be robbed. For "cutting" the glass for his work he used a "dividing iron," which appears to have been a thin rod of iron, curved at the end, and finishing with an iron knob. This dividing iron in a red-hot state was drawn over the surface of the glass wherever it was to be divided and then broken off with pincers and a grozing iron (*grosarium ferrum*). He gives very full directions both for painting the glass and firing it, entering lovingly into the minutest details of how to build the kiln.

Good old Theophilus! Though many have profited by your book, yet have none placed a window to your memory, though nearly a thousand years have given ample opportunity.

In our islands there is at the present day no entire window extant, however small, of the eleventh century, although many fragments are indubitably incorporated in windows of a later period.

One of the oldest Continental painted windows is that in the Church at Neuwiller, near Strasbourg. It shows a full-length figure of St. Timothy, and is surrounded with a richly coloured and painted border. This was painted early in the twelfth century.

At St. Denis, near Paris, is a window placed there by Abbot Seiger in 1108, but which has been so cleverly restored as to become almost worthless as an antiquity, because the modern additions are so near the ancient glass in colour, texture and manipulation as to defy detection, except on close view by an expert.

The colours employed in the twelfth century were very garish and primary, being principally red, blue and yellow, and to veto these colours and make their churches different to all others, the Cistercian Abbot in 1134 issued an interdict restricting the use of colours, and allowing only white glass to be used. Possibly this may have been out of compliment to the white habits or raiment of their order.

Of twelfth century work but little remains in England. In the nave of York Minster is part of a Jesse window of the end of this century, and, curiously enough, there is a fragment of a Jesse window of the same period in Canterbury Cathedral.

In the thirteenth century the monks, those clever illuminators, became very busy with stained glass, and seized upon it as a new recreative employment.

Their attempts were certainly of a crude and conventional character, but were frequently both effective and successful, and, in looking at their work, we must remember that their material and their tools were of the rudest kind—no modern brushes, no mills for turning out neat leads, no diamonds for cutting glass! Indeed, they must have been very clever to have produced anything at all worth looking at.

Their glass was very poor: coarse in texture, very uneven in thickness, and very limited in variation of colour. It was either brought to shape with the ancient dividing iron, or else cast in moulds, piece by piece, and then more nearly grozed to the required shape—a very tedious and uncertain method.

The brushes were so poor that the monks frequently used certain little pointed feathers from the wings of birds (especially the woodcock) for outlining or "tracing" upon glass. Their brushes were of their own manufacture, and consisted of little bunches of squirrel or badger hair, thrust through quills which were softened by soaking in warm water. Needless to say, not one of these primitive brushes in a dozen was of use in outlining, being too blunt ended, hence the use of feathers for that purpose.

Their painting colour was usually coarse, but has stood the test of time admirably, much of it being as firm and dense as when applied five hundred years ago!

Their only colour was of a purplish-brown, of a somewhat dark tone, and is supposed to have been composed of the following ingredients and proportions:—

Two parts of oxide of iron (rust); two parts of oxide of copper; one part of ground jet; and two parts of borax flux as a fusing medium, without which the colour would not adhere to the glass.

The figures painted at this period (thirteenth century) were merely outlines—very effective—in solid colour, and when any attempt at shading was made it was by means of cross-hatching—wash shading being then unknown. The drawings were exceedingly conventional, sometimes grotesquely so, and were it not for their sacred nature might at times be denominated ludicrous or humorous.

As yet the study of anatomy formed no part of the curriculum of the monkish studio, though it must be confessed their drapery was often very effective. Some of their most telling work was in the form of medallions placed on a painted quarry background. Frequently the medallions contained several figures, forming a biblical subject, placed on a blue or ruby background, as in Canterbury Cathedral, but no attempt was ever made to even hint at perspective—a man in the distance was drawn as large as one in the foreground. Such, briefly, was the state of the art at the close of the thirteenth century, at which period only the chief cathedrals and the richer monastery churches ever received these

> Storied windows, richly dight,
> Casting dim religious light.

It must not be supposed, however, that the productions in our islands during the thirteenth century could claim an equality with the best productions on the Continent during that period. We cannot justly claim to have had any particular master or mastery in the art, but on the Continent many well-known artists were already giving their full powers to the great art wave which was now sweeping over Southern Europe.

Among the best examples of thirteenth century work in England we may mention the following, which may all be termed Early English, being coeval with that period of architecture.

Many of the windows in Canterbury Cathedral were painted about 1230-1250, and after the lapse of six centuries and a half have lost little, if any, of their beauty, although they have from time to time been restored, releaded, etc.

Salisbury and Lincoln Cathedrals have their west windows filled with glass of this period, and the latter has a rose window said to be of tenth century work.

There are also the east windows of Westwell Church, Kent, and Chetwode Church, Buckinghamshire, each of mid-thirteenth century work.

Dating from about 1260-1290 are the Five Sisters in York Minster, and a window in Stanton Harcourt Church, Oxon.

In Dorchester Church is a medallion, date about 1230-1240, representing St. Birinius on his mission.

The fourteenth century was a very important one, embracing the "Decorated" period, a hundred years of wonderful progress in the art of glass painting. It was notable for at least two inventions, *viz.*, silver-stain and stippled shading.

Silver-stain, so called from being made from that metal, was of a beautiful transparent golden colour, and at once gave the glass painter a wonderful addition to his colours, wherewith to give fresh beauty to his art. By its aid he could impart to his white glass any tint of yellow, from the palest lemon to the deepest orange merging upon ruby.

Granting that the colours incorporated into the various "pot-metals," or self-coloured glasses, constituted them stained glass, yet here was a new pigment that would change even white glass into stained glass. This stain when once applied was as permanent as ruby, blue or green, because it stained or self-coloured the glass to some depth, and was only removable by removing the surface of the glass itself. By its aid quarry patterns and grisaille backgrounds became enriched; jewels could be set in golden surroundings without the intervention of lead; golden diapers on a white dress became possible; the crockets and pinnacles of canopies could be made distinct and beautiful; the hair of figures could be made to stand away from the pale flesh; flowers could be differentiated in colour from foliage; and in fact the invention of stain was the most important discovery that had either before or since been made in the art of glass painting, and marked the fourteenth century as one of wonderful progress and possibilities. It was not until the closing of the century, however, that the monkish painters became entirely aware of the wonderful properties of the new pigment in their hands.

The other discovery (stippling) was important, but not in such a great degree as the stain. Until its discovery there had been two methods of shading: the early one, in which finely traced lines called "cross-hatching" were employed; and the later one, called variously smear, wash, and flat shading.

This flat shading gave very good results in expert hands, but was apt to be unequal, muddy, or too pronounced at its edges, where it should soften off into light.

The "stippled" shadows were the outcome of the flat shading, and were probably discovered by some genius whilst endeavouring to smooth over his badly-laid wash-work by dabbing it with a stumpy brush, and thus producing a granulated surface, which, although acting as a shadow, would still permit a certain amount of light to penetrate, and thus render the former opaque shadows transparent.

The fourteenth century came in with flat shading, and went out with shadows in their incipient stage of stippling. During the fourteenth century the drawing of both figure and ornament was vastly improved; more attention was given to the pose and anatomy of the figures; drapery was arranged in a more natural and artistic manner; and the conventional forms of foliage and borders were much more correctly delineated.

Some amount of character and expression was now frequently introduced into the faces of figures, which in the preceding century had often been either doll-like, abstracted, or simply idiotic.

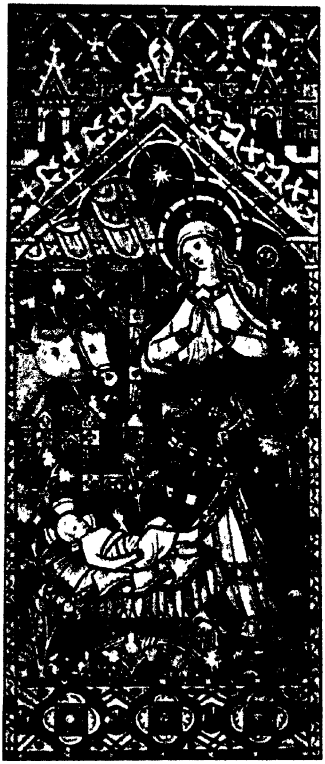


Fig. 1.—Typical Fourteenth Century Stained Glass.

Canopies commenced to appear, very small and meaning-less at first, but with succeeding years they grew taller and taller and more ornate, until at last it might be said the figures beneath them were only of secondary interest, the big, gaily coloured canopies monopolising, in some cases, half the height of the window, making the figures appear unduly small and insignificant. Tall spires and pinnacles arose one above the other, until a plethora of richness of detail was achieved such as had never been seen before, but with all this the canopies and their members were kept severely flat, no attempt at rounding of detail or striving after perspective being made or suggested.

Many portions of the architectural work were coloured green, red, or blue, which certainly gave richness and local colour, but it cannot be said that the effect thus gained was good, although, to untrained eyes and minds unaccustomed to art, the appearance of these windows must have been simply grand. So much colour had the effect of giving that awesome, dim, religious light to the churches which in the dark ages was mistaken for sanctity, just as the misty, dreary lives of the ecclesiastics of the period was mistaken for fervour and true religion.

If we glance at a fourteenth century canopy we shall notice that it was drawn so as to carry out the stone carving of the decorated style. Mullioned windows were shown in these glass canopies, with their pierced traceries and their wealth of accessory detail, just as the actual stonework of the windows was worked ; indeed, it is by this parallelism of style that the approximate date of these windows can be in a great measure fixed.

The hundred years during which the Decorated Period continued saw a very great improvement in stained glass, but the heavy colouring of the canopies left much to be eliminated in future generations. Instead of being lightly coloured, so as to act as a foil for the richly coloured figures beneath them, they were frequently as highly coloured as the figures themselves, so that the whole appearance was heavy, massive, and cumbersome. Still, with all its imperfections, the Decorated Period paved the way and laid the foundations of the glories soon to follow.

Among the many examples of fourteenth century work extant some of the earliest may be seen in the Chapter House of Salisbury Cathedral. Others are the east window of Checkley Church; Merton College Chapel, Oxford; east window Selling Church, Kent; the side windows in Norbury Chapel, Derbyshire; the Chapter House of York Minster; Chartham Church, Kent; and considerable remains in Peterborough Cathedral.

The east window in Stanford Church, Northamptonshire, and a window in Froyle Church, Hampshire, date from about the latter part of the reign of Edward II.

Of about the same date may be mentioned the fine choir windows in Bristol Cathedral, and others in Tewkesbury Abbey and Wells Cathedral.

The windows in the nave of York Minster are very instructive, as they were inserted at various dates from the beginning to the middle of Edward III.'s long reign, say between 1350-75.

In Bardwell Church, Suffolk, is a well-drawn figure of Sir William de Berdwell. The knight is in complete armour, with his war heaume at his side. His coat of arms on his shield is on a field gules, a goat rampant, argent.

Another figure of a knight in full armour may be seen in Long Sutton Church, Lincolnshire. The armour is plate armour, except the camail at the neck, which was the last link remaining between chain and mail armour, and proclaims the date to be about 1380. In Selby Abbey Church are several figures of knights on foliated background, and with well-painted borders containing squirrels, lions, and other animals and devices.

Abroad the art was prosecuted with great vigour during the fourteenth century, and the drawing was often very fine, but then it must be remembered that in England it was usual for the monkish painter to draw his own cartoons, a practice that was not always the case abroad, as there are numbers of instances on record of the cartoons being drawn by noted artists, and carried out afterwards upon the glass by professional glass painters. Here is one : —

In the Archives of Florence Cathedral it is recorded that "a window over the door towards the street of Cassattali is commissioned of Antonio of Pisa, master glass painter, and the design is by Angelo Gaddi ".

The date is 1348, and the window is still in existence—single figures under coloured canopies ; a jumble of colour with but little harmony, and an effect not wholly artistic.

It may be interesting if for a few moments we look into the ways and means of mediæval glass painters, and see how fourteenth century glass painters were paid for their services, and note the material worked upon. We take the latter first.

The glass used during the fourteenth century as far as, say, 1380 was of poor quality, about which period it was greatly improved by fresh makers taking the art in hand and using finer materials, and taking greater care in the mixing and blowing of the glass.

In the twelfth and thirteenth centuries the ruby had been very thick, dark, streaky and spotty, and the "flash" of ruby was quite half the thickness of the whole sheet of glass; but this "flash" was gradually reduced, generation by generation, until by 1380 it was only about one-fourth of the whole substance.

Blue glass was usually of a purplish hue, and at times very "inky and horny" in appearance.

Green was frequently of a severe and staring type, and full of little impurities of a stony nature, which rendered it difficult to shape to the required form without breakage, the glass being apt to fly or fracture at these little stony oases.

White glass was blown in a very irregular manner, which, while it gave vigour and tone to plain leaded work, was not conducive to good painting.

A little yellow and purple glass completed the mediæval glazier's store of glass.

Glass was then known by the names of the various gems whose colours it represented --thus they had *ruby* for red; *sapphire* for blue; *emerald* for green; *crystal* for white, etc.

Now for the pay of the mediæval glass painter and glazier. Between June and November, 1351, the windows of St. Stephen's Chapel, Westminster, were glazed by John of Chester, who was paid 7s. per week, or five guineas for the fifteen weeks during which his services were required.

He certainly had plenty of assistants to help him, and their wages are duly and fully recorded. Five men, who appear to have been designers, received almost as much as John himself, namely, 1s. per day, or 6s. per week. Fifteen men were employed to paint on the glass at 7d. per day, or 3s. 6d. per week—a not very high wage; while twenty-three glaziers, who cut the glass and afterwards leaded it together, were content with 3s. per week—a sum which, to twentieth century ideas, appears very small to support a wife and family upon. But it must be remembered that the purchasing power of money was then at least fifteen times as great as at the present day. Four grinding boys (colour grinders) received 4d. per day, which was high wages for such work.

Contrast these wages with that of other workmen employed at the same time and on the same building, and it will be seen that glass painters and glaziers were well paid.

Carpenters received 4d., 5d. and 6d. a day, according to their ability; masons, 5½d.

The master mason and the master carpenter, William Hurle, who carved the stall ends and superintended the wood work in general, received the same remuneration as the glass designers, *viz.*, 1s. per day; so we see that the master glass painter, John of Chester, received a higher wage than any other.

Glass in those days was sold by the "ponder," which equalled 5 lb. A "ponder" is the same weight as the modern glass "stone" (5 lb.).

The price of the glass used by John of Chester was:—

White glass	6d. to 9d.	per ponder.
Blue ,,	1s. to 3s. 7d.	,,
Ruby ,,	2s. 2d.	,,

By this we see that coloured glass at this period was very expensive in comparison to what it is in modern times.

Supposing the purchasing power of money in 1350 to be fifteen times greater than at the present day, and the "ponder" to be equal to 4 square feet of glass, the prices would work out thus:—

	1350.	1900.	
Ruby glass	8s.	2s. to 3s.	per sq. foot.
Blue ,,	3s. 9d. to 13s. 6d.	1s. 6d. to 2s. 6d.	
White ,,	1s. 10d. to 2s. 8d.	1s. 6d. to 2s.	

On the same principle we can compare the rate of wages:—

	1350.	1900.	
Chief draughtsman	£5 5 0	£5 0 0	per week.
Ordinary ,,	4 10 0	3 0 0 to £4 4 0	
Glass painter	2 12 6	2 2 0 to 3 10 0	
Cutter and glazier	2 5 0	1 16 0 to 2 5 0	
Labourer (grinder)	1 10 0	1 0 0 to 1 10 0	

By which it will be seen that the remuneration has really altered but little, only the purchasing power of money has declined.

In 1357 we read of a window containing 40 superficial square feet being glazed at 1s. 2d. per foot, but no statement is given as to the kind of window or its pattern.

In 1365 a window of 97 square feet "wroughte wyth floures and ye Kyng hys armes" cost 1s. 2d. per foot—say 17s. 6d. present money. Probably this was a painted quarry window, or one of grisaille pattern, with the king's arms as a central medallion.

In 1338 the great west window in York Minster was glazed, and it is recorded that the glazier found the glass, cut it and glazed it, for the sum of 6d. per foot (about 8s. 6d. present day). This would probably be some kind of geometrical plain glazing in white glass.

Coming to a later date, 1405, we find a record of what was paid to John Thornton, of Coventry, for glazing the great east window. It was a somewhat curious bargain, *viz.*, he received 4s. per week during the time he was employed, £5 at the end of each year, and a £10 honorarium on completion of the window, which was considered very satisfactory. It took three years to complete, so that he received in all £56 4s., or about equal to £800 present money!

In 1447 the windows in Beauchamp Chapel, Warwick, were glazed in "glass from beyond seas," according to patterns given by the Earl of Warwick. This appears to mean that the glass was cut and painted abroad, and glazed in England. The cost was 2s. per foot = 24s. present money.

Now we must leave prices and workmen and get back once more to the styles of glass painting.

The Decorated Period is usually placed between the years 1280 and 1380, and the Perpendicular Period from 1380 to 1530, but it must not be supposed that the one style ended and the other commenced precisely in 1380. There was a lapping or transitional period during which the design hovered between the two styles; flat shading had not quite given place to stippled shading; white glass had not altogether superseded coloured in the canopies, and silver-stain had not taken the hold upon and influenced the style as it did in pure Perpendicular work.

If we wish for examples which were painted during this linking or lapping period, we shall find a few still in existence. Perhaps the best example is the east window of Gloucester Cathedral, which was painted between 1350-70, and was then one of the finest in England. Six figure windows in Merton College Chapel, Oxford, were painted about 1360. There are also other windows of the period 1360-80 in the Chapter House of York Minster, and some coats of arms, of rich colouring on a pale stained background, at Norbury, Derbyshire.

Before speaking of the Perpendicular style we will take a brief glance at the quarry (diamond pane) windows. These quarries (from the French '*carré*') were lozenge-shaped pieces of glass charged with some little device in outline, as a conventional flower, an animal's head, a plant, foliage, monogram, crown or emblem of some kind.

In the thirteenth century examples they usually had a little painted border running along the two upper sides, beneath which—in the centre of the quarry—a little device, usually of a floral nature, was outlined, the background being carefully cross-hatched with fine black lines of grisaille placed about an eighth of an inch apart.

Stain was not invented, so that a quarry of that period was simply a black pattern on a white ground. During the Decorated Period the little bands were usually omitted, and the devices made more elaborate, whilst in the later years of this period the devices were generally stained. The first stained quarry dates from about 1320. Perpendicular quarries

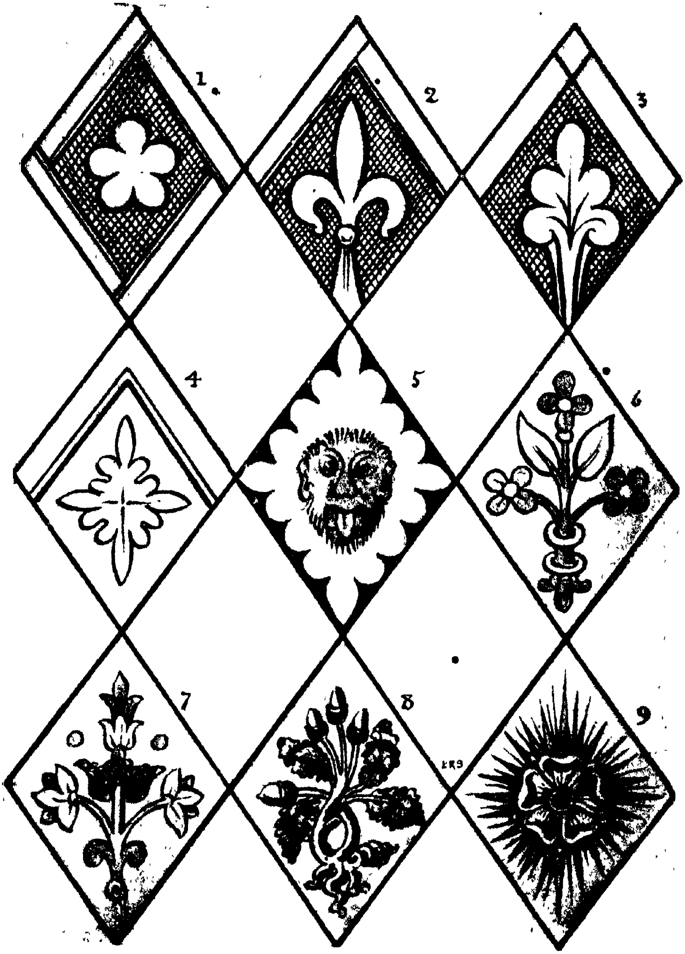


FIG. 2.—Quarries: Types of Different Periods.

EARLY ENGLISH—
1. Canterbury Cathedral.
2. Southam, Norfolk.
3. Lincoln Cathedral.

4. About 1320.
5. Stained Quarry, about 1350.
6. Decorated, about 1380.

7. About 1400 to 1420.
8. About 1450.
9. Edward IV., Yaxley, Suffolk.

were usually of an elaborate design, in some cases floral, and in others bearing well-executed monograms or even heraldic charges. They were invariably stained, and frequently shaded so as to make the devices appear in relief. A study of the quarries here shown will give a fair idea of the various types of quarry in vogue at different periods.

Grisaille work, which probably sprang from painted quarry work, was an elaborate confection or combination of the painter and glazier. The latter not being content with the beauties of his geometrical lead glazing (in which the patterns were separated by bands of coloured glass, and elaborate borders used) was fain to call in the art of the painter, who embellished his backgrounds of white glass with wonderful foliated scroll and cross-hatched work, so that most beautiful results were arrived at, as witness the huge celebrated Five Sisters window in York Minster.

Sometimes grisaille formed the background for coloured medallions, and at other times figures were introduced with good effect. It is somewhat difficult to say precisely when grisaille work was introduced, but many very fine examples are extant of all dates, from 1250 to 1400.

The Perpendicular era embraced the period 1380 to 1530, a reign of 150 years. This period might with advantage be subdivided into the Early Perpendicular from 1380 to 1450, and the Late Perpendicular from 1450 to 1530, or even twenty years later.

During the early era the canopies were noticeably flat, and still retained a little coloured glass, as in the vaulting under the architectural work, but the true feeling or aim of the Perpendicular artists quickly asserted itself, that of producing a fully coloured figure with a rich background, surrounded with beautiful gold and silver architecture; practically colour upon a white background, or, as a herald would express it, a tincture upon a metal.

The figures of the early period still retained enough of the quaintness of pose and expression, and the subjects such peculiar surroundings and ideas as to denote that although painting had advanced greatly, yet there was much need of better drawing and more study of anatomy, drapery and accessory details before anything like perfect harmony could be attained.

Gradually the colouring of the windows became more harmonised, the garish colours softened down, and the draughtsmanship of both figure and ornament vastly improved. Not only was the artistic portion of the window raised to a higher level, but the material upon which the artists worked—the glass—was now taken in hand and greatly improved in colour, thickness and texture.

Of Early Perpendicular work there are many fine examples left to us, among them being:—

New College Chapel, Oxford; Winchester College Chapel.

There are three early windows in the clerestory of the choir of York Minster, and the east window of the same building was placed there in 1405, and other windows during the reigns of Henry IV., V. and VI.

The windows in the transept of the Ante-Chapel in All Souls Chapel, Oxon., are of the time of Henry V. Of the reign of Edward IV. there are windows in both Great and Little Malvern Church.

In Italy many fine windows were painted between 1400 and 1450, many of the cartoons being drawn by celebrated artists of that wonderful age of art revival, and in several of the windows the influence and style of such truly great artists as Giotto and Orcagna are clearly observable, especially in the twisted columns and quaint niches and gables for which those artists were noted.

In the Archives of Florence Cathedral is an entry under the date 1437, which lets a little light into the price paid to and the mode of working of the artists of those days :—

"Paid to Lorenzo di Bàrtoluccio (Ghiberti) seven florins, being the half of the price of his skill and labour for drawing four figures on paper of bombagia, for a window to be executed by Bernardo di Francesco, at three livres per figure."

Here we have the price for drawing and painting the figures, and we know that "bombagia" was a coarse cotton material.

The Italians claim that Beate Giacomo, who practised glass painting at Bologna, invented "stain," but this is an error, as Giacomo died in 1491, while stain was known in England more than 150 years before that date.

The Later Perpendicular era, and even as far as 1560, saw glass painting in England at its zenith, and not only that particular art but almost all other arts.

The skill of the armourer was at its greatest; his craft having made armour to fit the human figure to perfection, and to give it the mastery over the weapons of the period, turned to the embellishment of the work, and marvels were wrought in steel. The "latten" (or monumental brass) engraver now produced his finest work, thanks to the armour and costumes of the day. Tapestry as an art never flourished more, and many grand examples of this epoch are now in our museums and the seats of our nobility.

The costumier of this age went to the most extravagant lengths in producing not only grand garments, but, his inventions running riot, he frequently came perilously near the grotesque and ludicrous in his striving for new fashions.

This period saw the glories of architecture carried to a point as near perfection as the world has ever seen, and hundreds of churches now standing testify to the cleverness of the architect and the skill of the builder, the wood carver, the stone mason, and the smith.

With such perfection in contemporary art work, can it be wondered at that glass painting also reached its zenith at this time?

Many of the canopies of this era were veritable masterpieces, and the proportions between subjects and figures and the architectural portions of the windows were frequently very harmoniously balanced. There was no set rule, but in single figure windows the proportions were about as follows:—

The figure took up nearly half the height of the light, the canopy nearly a third, while the height of the base was about equal to the width of the light. The shafting on each side might be about one-sixth of the width of the light. An example of this may be seen in the "Madonna and Child" window of All Souls College, Oxford.

The figure shown on next page is a typical one of the sixteenth century, bold and vigorous, the lead lines being unnoticeable except where they divide the spear into manageable lengths.

Among the finest examples of this Late Perpendicular style are the noted windows at Fairford, in Gloucestershire (1500-1520), perhaps the finest collection of windows in England; although the less known windows of St. Neot's Church, Cornwall, are almost if not quite equal to them, and the writer would like his brother antiquarians to make a special visit to inspect them.

Whether either of these collections were the work of the British school is more than doubtful, probably they were of Flemish workmanship. It has been said that Albert Dürer made the cartoons for the Fairford windows, but this has not been proved—the folds of the drapery are unlike his work.

The fine east window of St. Margaret's Church, Westminster, which has quite a history attached to it, is certainly foreign work, and in some respects a fine window.

Probably much of the work which we ascribe to foreign studios was really painted in England, but by foreigners, many of whom came to England between 1500-1550.

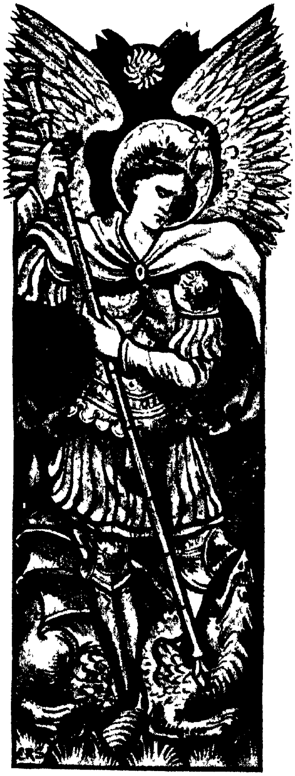


FIG. 3 —St. Michael and the Dragon.

There is a fine example of Flemish glass in Lichfield Cathedral, some considerable remains in Martham Church, Norfolk, and in many other places.

It must be noted that during the Perpendicular Period no enamel colours were used, if we except, perhaps, flesh red, which made its appearance about 1510.

For obtaining the beautiful diapered patterns on ruby dresses a mode of removing the "flash" of the ruby by abrasion was introduced about 1450, and nearly one hundred years later this function was performed with the aid of a roughened steel wheel, which chipped and rubbed away the surface until the white parent glass was reached.

By the way, ruby glass was now made much more scarlet in tone than formerly, and to facilitate the operation of "diapering" the flash was made much thinner, only about one-fourth the total thickness. Nowadays the "flash" is only one-sixth or even one-eighth the entire substance of the glass, and is readily eaten away or destroyed by using hydrofluoric acid.

During the later period most of the coloured glass was made less deep in tone and less gaudy or harsh in colour.

Lofty windows were frequently cut up into tiers or rows of figures or subjects, which were separated by short canopies or sub-bases. This arrangement gave a very fine effect; the white architectural work and the fully coloured figures or subjects acting as foils one to the other, and harmonising very effectively with the buildings in which they were placed.

Perspective was introduced with happy effect both in canopies and subjects, and with these marked improvements stained glass arrived at its greatest perfection.

What some call the Cinque-Cento style lasted from 1500 to perhaps 1560, and some few examples of it may be seen in various parts of England.

King's College Chapel, Cambridge, has a number of windows in this style painted between 1520 and 1530, whilst Balliol College Chapel, Oxford, also has some examples of the same date.

Lovers of sixteenth century glass, when near Shrewsbury, will be amply rewarded by visiting St. Mary's Church, which contains many unique specimens, upon the inspection of which a couple of hours may be very profitably and enjoyably spent.

Many critics place the Cinque-Cento style as the pinnacle of the glass painting art, and really with good grounds, as the many beautiful examples existing will prove.

The style was characterised by the employment of the Italian or Renaissance ornament, which is so easily handled and adapted to the glass painter's art.

Sometimes the Renaissance and the Gothic styles were to some extent blended, and frequently with happy results when in capable hands, but before the style could be brought into a true and distinct type the Reformation came like a mighty cloud over our land, and by its dense shadow blotted out, or nearly so, the rage for glass painting and other art work, which had for ages held its beneficial sway over England.

For the time being stained glass was banished from the church to find only a moderate shelter in the houses and halls of the upper classes, and the castles and mansions of the nobility.

Gothic architecture and glass painting, which for centuries had gone like brothers, hand in hand, gradually sickened and became invalids together, but neither of them actually died, although they came perilously near doing so.

About the time of the sickening of the art in England it came to its greatest perfection in Holland, as many great and beautiful windows testify.

Among the chief practitioners of the art were two brothers, Diedrick and Wouter Crabbeth (or as we should call them, Theodore and Walter), who for many years carried on the art, jealously guarding the secrets of their profession by never speaking upon the subject before a third person.

They dwelt and painted for many years in Haarlem; and the huge windows in St. Jan's Kerke, Gouda, which were painted between 1565 and 1603, may still be seen by travellers. They have a style of their own, and show a very liberal use of enamel colours, which, by the way, were introduced into England about 1550.

For those who have a *penchant* for arithmetic we may relate that the great window, "The Offering of Elijah," painted by the Crabbeths, contains 805 square feet, and was paid for at the rate of 10½ stivers per foot.

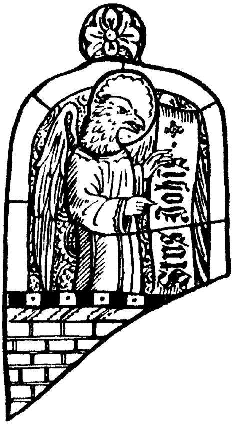


FIG. 4.—St. John (Tracery Piece).

Dwellers in London may see a fine Renaissance window in St. George's Church, Hanover Square.

Of the eccentricities and curiosities of stained glass a long chapter might be written, but we have room here for only one example, a humanised eagle representing St. John the Apostle. Even staid old monks enjoyed a little humour.

The introduction of enamel colours into England about 1550-60 helped or commenced the decay of stained glass, which so early as the end of the sixteenth century may be said to have become a neglected art, for in even the early years of the seventeenth century we shall look in vain for examples that could in the least compare with the glories of the beginning of the previous century.

In Balliol College, Oxford, is a large window painted in 1637 by Abraham van Linge, but although it has its merits in drawing, etc., the unsparing use of enamel colours gives it a dull, subdued appearance, its brilliancy being entirely lost by the employment of enamels instead of pot-metal glass; hence a dull, sad look, instead of a bright, joyous piece of work.

In Christ Church College Chapel is another specimen by the same artist, by which it may be seen that he had entirely missed the true mosaic spirit of glass painting by relying upon enamels—in other words, he mistook glass for canvas.

Wadham College, Oxford, has a series of twelve windows painted by Bernard van Linge in 1622. They are carefully drawn and fairly coloured; but the aggregate area is so great that the work could not have been the sole work of one pair of hands; probably he was responsible for the drawing of the cartoons, and had a staff of Flemish painters to execute the actual glass for him.

In 1638 two windows were painted by one, Baptista Sutton, for St. Leonard's Church, Shoreditch, which were similar to those just mentioned.

William Price, the only seventeenth century artist of note, is responsible for a large and very poor window in Merton College Chapel. It is a fair specimen of the art of the period; but the very best windows then painted were only mediocre, while many did not reach even such an unenviable level.

The truth is, the art of mosaic glass painting had been almost lost sight of, and in adopting the enamel style of glass painting the artists had only the choice of two evils : to paint in a transparent style and so produce thin, washy work, or to paint in an opaque manner (as in canvas painting) and so produce a turgid, dull and dense effect, lacking translucency, brilliancy, purity of colour, and every other attribute of a good window. But if the seventeenth century produced nothing better than poor glass, what shall we say of the eighteenth century work? What can we say in its favour other than to thank Providence there was but very little of it!

One, Peckitt of York, has left an unfortunate record of the dire decay into which glass painting had fallen in the eighteenth century, by painting some windows in the north side of New College Chapel, Oxford (facing the Linge windows), which are dated from 1765 to 1774.

Better than Peckitt's windows were some specimens painted fifty years previously by William Price, junior, son of the painter of Merton College window. They may be seen in Queen's College and Magdalen College, Oxford. They are well drawn, but the style of painting is more suitable for canvas than for glass. The skill of the artist is evident, but the execution of the true glass painter is absent.

In this century lived an artist named Rowell, who painted a great deal of work for the Earl of Pembroke, but he evidently lacked the method of preparing his colours, which after a few years faded away, as he himself did after inventing a beautiful red or ruby colour. The secret of his invention, he would not divulge, even on his death-bed, and he carried it to his grave. Probably his secret was for the manufacture of ruby enamel ; if so, its importance was not of very great value, and it has since been rediscovered.

In 1757 there was a glass painter of Birmingham who painted a window for Hagley Church, commissioned by Lord Lyttleton, but becoming bankrupt he painted no more. Probably he found more pleasure than profit in the art.

Peckitt of York did not die until 1820, when he must certainly have been a very old man. "Ars longa, vita brevis" is a usually accepted dictum on art, but, fortunately for posterity, Peckitt reversed the order. Other English artists of the eighteenth century were Forrest, Frank Egerton, Henry Giles, Robert Godfrey, and, last but not least, Jervais, who early in the century painted the great window in New College, Oxford, from the cartoons of Sir Joshua Reynolds, and by some strange delusion mistook glass for canvas, and so painted a dreadful daub, and left on record a wonderful capacity of inability as a glass painter.

Glass painting never entirely died out, for during the last third of the eighteenth and the first third of the nineteenth centuries many persons dabbled in the mysteries of the art, but produced absolutely nothing worth looking at in the way of church windows, but this particular period was noticeable for the number of medallions which were painted in the Flemish and German style. They were usually squares or circles of white kelp glass, about a foot across, charged with scriptural, historical or mythological subjects, coats of arms, flowers, etc.

They were painted on good but thin glass, and were well drawn, painted and shaded; the only colour used beside the brown colour being stain, and the effect was good, as the work was carefully and well executed.

They were usually leaded up with some colour in the border, and readily sold for from one to five guineas apiece, and were frequently leaded into hall, staircase or dining-room windows, *in which positions they may still be seen* in some of our old country halls and mansions.

So, with the patching and tinkering of existing windows, we come down to the time of the revival of glass painting in England, which we may say really commenced about 1840, when Lord Rollo and other noblemen caused windows to be painted as gifts to various churches.

The attempts of the revivalists were, naturally, unequal in merit, and were frequently total failures ; but the impetus given to the resuscitation was a genuine striving to regain an almost lost art, and caused a certain amount of rivalry among the few glass painters then in practice.

Their drawing lacked the vigour of the old master painters, and they fell into the grave error of blending the styles of two or three periods into one window, making an incongruous hash of the whole.

Their glass was of the worst possible description for glass painting purposes, thin, flat, and of the same tone throughout the sheet. The blue was reminiscent of washing-day and its accompanying blue-bag ; ruby—blood red, and without variation of tone ; green—of the grass or cabbage tint ; and yellow of a flat and gaudy amber.

Their painting was the only redeeming point of the revivalists, windows painted between 1840 and 1860 being often skilfully and artistically executed.

After 1860 very rapid strides were made in the art, the foundation of which was the discovery of the ancient methods of making glass, or rather of the component parts of ancient glass.

This joint discovery and manufacture of "antique" glass by Winston, a lawyer, and Powell, a glass maker, made it, for the first time for nearly 300 years, possible to paint good windows, as the tone, texture, translucency and brilliance of the work was thereby assured.

This rediscovery of antique glass was not accomplished until a large sum of money and much time and patience in experimenting had been expended ; but modern scientific and analytical knowledge, which knows no impossibilities, was brought to bear upon the subject, and, as mentioned, about 1860 the first sheets of "antique" glass were placed on the market and quickly seized by stained glass artists, making it clear to the makers that a demand for such glass did exist, and they therefore persevered with its manufacture and improvement.

At the present day as fine, and in many cases even finer, glass is made than in the palmiest days of monkish painters. Its texture, variety of tone and thickness of substance, its translucency and brilliancy, leave nothing further to be desired or sought after.

The rising generation of glass painters were carefully taught the art, and men made it the study of their lifetime, finding that the remuneration attending excellence in the art to be worth striving for, so that with the study of years the ordinary painter became truly an artist, loving his lasting art, and enjoying the profession which gave him such scope and possibilities of effect.

The designs and cartoons are now the special work of trained draughtsmen, men who have from early youth made a study of drawing for glass, and which can only be accomplished by those who are thoroughly versed in style, costume and technique.

Many royal academicians and other noted artists, from Sir Joshua Reynolds downwards, have tried their hands at drawing cartoons for glass, but nine out of ten have been obliged to admit failure. Some have just scraped through the ordeal with the help of practical glass painters who have been allowed to make "little alterations". Among those who have successfully drawn for glass are Burne Jones, Stacey Marks, Cope and others.

This is essentially an art age, and probably the school of draughtsmen of the present day (those who have been trained for nothing else but glass) are superior to the best designers and cartoonists of the fifteenth and sixteenth centuries.

In glass drawing and painting it is no exaggeration to affirm that at the present day windows are executed which may vie with anything produced in mediæval times.

Certainly the painting of ancient glass can be quite equalled by the best modern painters, and the world has never seen finer glass; besides which, modern brushes and appointments play a prominent part with latter day work, so that altogether there is no excuse if good work is not produced if properly paid for.

There is perhaps only one point in which ancient glass has any advantage over the best modern productions, which is that over the ancient work the hand of old Father Time has thrown a glamour, a pearly lustre, which gives a mellow, soft tone, and blends all the paler tints into one glorious harmony.

The revival of glass painting in England has increased the number of firms from four or five in 1845 to about 300 at the close of the nineteenth century.

Of this number, however, but few understand the true principles of the art, many of the so-called "firms" being house decorators or co-operative stores.

Of the true painters, men of skill and artistic training, there are *fewer* than the number of glass painting "firms"—possibly they may number from 200 to 250.

Many of the so-called "firms" of stained glass artists are merely ornamental lead glaziers, who upon receiving a commission for a painted window either farm it out to another "firm," or produce a window of their own, which will be handed down to posterity as an example of English art work of the twentieth century!

In a book of this kind it would be somewhat invidious to point out the finest windows painted, say, during the past twenty years, although such a task would to a connoisseur be a very interesting one, but being one of the craft the writer cannot with wisdom indulge in such a pleasure.

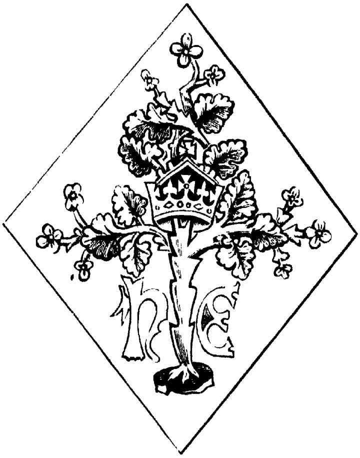


FIG. 5.—Quarry of Henry VII.

CHAPTER II.

DESIGNING SCALE DRAWINGS.

THE actual design of a window, apart from its drawing or painting, is of paramount importance; and more study and practical knowledge must be expended upon it than upon any other stage of the many processes which go to the making of a stained glass window.

Consideration must first be given to the space to be filled, and as the stonework allows only a limited breadth of glass between the mullions, care must be taken to avoid an overcrowding of figures in the subject selected.

A beginner, even though he be a very clever artist on canvas, had better limit his first efforts to single figures, by which means a quicker knowledge of "drawing for glass" will be obtained. He will more rapidly acquire the knack of hiding the lead lines, discover the best folds for drapery, the most effective backgrounds, and the modes of diapering, etc. Small canopies and bases, too, will have to be shown, and these will open to him a wide study as to style and purity of detail of the various architectural members which go to make a well-balanced setting to the central figure.

Having thoroughly studied the contemplated window in one's mind before putting a line on paper, the first step is to decide to what scale the "small design" is to be made. It is imperative that the design be made to an exact scale, or it would be impossible to draw the cartoons or full-sized drawings from it, so that every part should work out in due proportions to the actual window.

Any scale may be chosen in which the draughtsman feels he can best render his ideas of the resultant window. Some are content in a small design to give just a mere outline of the pose of the various figures, and a very sketchy outline of canopies, bases, shafts, etc., without any attempt at lines of drapery or architectural details, simply trusting to a colour scheme and the due balance and proportion of the various sections of the window as a whole. Such a design might be drawn to half-inch scale; that is, each half-inch of the small design would represent a foot in the actual window. Such a scale should only be used by the expert draughtsman, whose years of study will enable him to portray the general effect of the finished window without taking detail at all into consideration.

Those not conversant with drawing for stained glass should work to a larger scale. Some who put great thought into the work will adopt even a two-inch scale, and cram in every bit of detail as if it were the design and not the glass which was ultimately to be held up to admiration.

Experience shows that much time thrown away on the minute details introduced in a scale drawing might more appropriately and beneficially be used upon the drawing of the large cartoons. A two-inch scale requires so much elaboration, that nearly as much time is expended upon it as upon the full-sized cartoons of an ordinary window.

To the art amateur time is of little moment, and the hours devoted to gathering and planning the items of a design are hours of pleasure; to the art workman hours spent in drawing of needless minutiæ may be hours of purgatory.

It must not be imagined, however, that any slovenly sketch will do as a design, for on the carefully thought out attributes of a window depend the making or marring of the whole final effect.

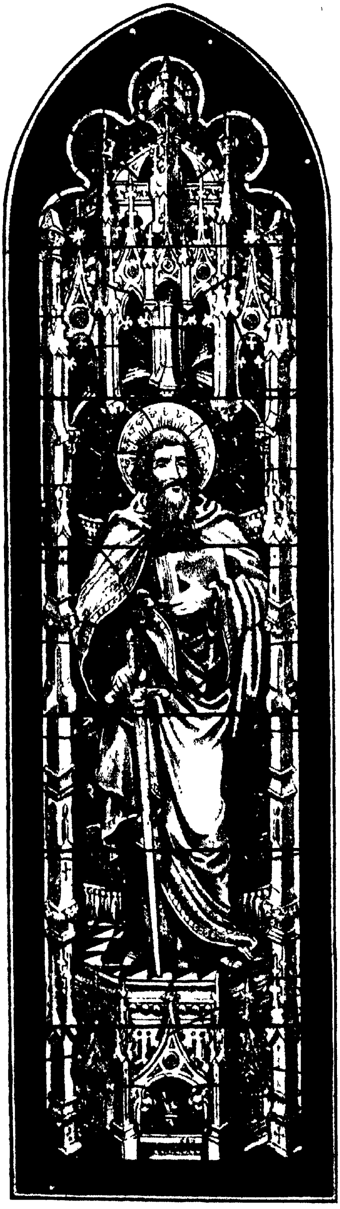
Balance of proportion in the various parts, depth and amount of colour, size of figures, style of architectural surroundings, treatment of canopies and bases, position of bars for fixing, and a hundred other things must find illustration in the design, and must each be fully and finally discussed in the draughtsman's mind before a line is put on paper. Probably the best scale for a design will be one inch to a foot—each eighth of an inch = one and a half inches. For all practical purposes such a scale is ample to give the true effect of both figures and colouring, without allowing too much scope for the introduction of minute detail. This scale is used by most English firms, unless every line of drapery and the expression on the faces are to be shown, when either one and a half inches (one-eighth = one inch) or the two-inch scale is adopted.

To avoid mistakes those designing for the first time might try the inch and a half scale, as they have only then to remember that one-eighth of an inch in the design represents one inch in the cartoon. For instance, if the actual figure in a window were to be two feet high, it would be represented in the design by one three inches high: thus, when drawing the cartoon from the small design, we might measure the latter from the head of the figure to its waist, and find it seven-eighths of an inch, and we should then know we must draw it seven inches in the cartoon; from top of head to chin might be three-eighths of an inch, and we should therefore draw it three inches, etc., etc.

Now let us see how a design is made. Every artist has certain manners and ways of setting about the task, and differs from his fellows in scale, kind of paper used, mode of colouring, way of finishing, style of mounting, and other items; but we will give an easy and agreeable method which all can grasp, providing that at the outset the person about to design is a fairly good draughtsman and colourist; in other words, that he has learnt the A B C of art.

The usual kind of paper used is Whatman's. This should be "hot-pressed" for very small designs, or N.H.P. (not hot-pressed) for larger designs. If a piece of the required size is cut off it should be slightly damped with a sponge and clean water on the back, and when limp attached to the drawing board, either by pasting round the edge or with drawing pins. It should then be stood in a warm place and allowed to dry naturally, not by being placed near a fire. When dry proceed to make a pencil scale in one corner of the paper from which to work. Draw a straight line three inches long and divide it into three equal portions, each of which will represent a foot. Next divide the first inch into twelve parts, each of which will represent an inch on the design. The space to be covered by the design must next be marked upon the drawing paper; let it represent a window six feet high by one foot six inches in width. Our space should therefore be six inches high by one and a half inches wide; this we draw, and surround it by another line forming a Gothic head, half an inch larger all round than our window. This space should then be filled in black, which may be done by using Stephen's ebony stain, which, by-the-bye, makes a capital ink when somewhat diluted, and is a very handy pigment for artists who desire an intense black in their working drawings. Next comes the question, "What shall be our theme—a figure or subject?"

We will try a figure standing on an architectural base, and surmounted by a fifteenth century canopy, just sufficient to give an idea for making a design, and leaving it to the practised draughtsman to evolve more elaborate and larger designs from his own ideas, but still following the general rules here mentioned.



Early Sixteenth Century Window: Typical Perpendicular Work.

Our figure shall be one of St. Paul, and our aim shall be to have a richly coloured figure on a coloured background, surrounded by architectural accessories of a pale tone stained in certain parts, giving a silver and gold effect.

For a window six feet high we may have a figure occupying half the height, which will give dignity and size to St. Paul, rendering him the centre and source of attraction and colour, and yet leaving ample space to show beautiful surroundings of enriched Perpendicular work.

The canopy may occupy from one foot nine inches to two feet, say a third of the total height, and the base and inscription a foot, or one-sixth of the whole height.

We therefore draw a faint vertical line down the centre of our paper, and mark it off into six parts, or feet, *viz.*, two parts for canopy, three for figure, and one for base.

Whether the figure or the "ornament" is put in first is perhaps of little moment, but the figure being the principal part of the window is usually attended to first by most draughtsmen.

"Where do you get your idea of the figure from?"

Well, a trained draughtsman has little trouble in that respect; he poses his lay figure or gets a friend to stand for him, and sketches the pose, afterwards adding drapery with swinging but simple and few folds. Enrichments in the way of borders, diapers, jewels, etc., are an after consideration, and concern the cartoonist rather than the designer.

Practice at drapery gives the experienced stained glass artist such facility that he can sketch out a figure in an hour such as it would take an ordinary draughtsman a day to invent; such is the quickness and foresight given to one practised at figure work that expert men require no small design whatever, or at most a very rough lead pencil sketch.

For the amateur who has not the gift of inventing his own figures, poses, or drapery, let him visit some of our churches, the National Gallery, South Kensington Museum, or even any print or photograph dealers, and he will doubtless obtain what he requires in the way of figures, or, should he be on speaking terms with a stained glass artist, let him borrow a suitable figure.

The water-colour rooms of the National Gallery, situated under the galleries containing the oil paintings, are not visited by a tithe of those who make a cursory round of the building; but students of stained glass will find a wealth of fifteenth, sixteenth and seventeenth century work hung on the walls of these downstairs rooms, which contain many very fine studies of figures eminently suitable for stained glass, with a very little in the way of alteration or adaptation.

Having obtained a study of St. Paul suitable for the purpose, draw it carefully on a separate piece of paper, and make all necessary alterations. Then, being satisfied with your figure, trace it with a fine pen and ink on tracing paper, and transfer it to the space reserved for it on your drawing paper. This may be managed by well rubbing the back of the tracing with black lead pencil, and then transferring by going over all the lines with a stylus of bone, ivory, or steel. Sufficient pressure to transfer the black lead should be used and no more.

When transferred, go carefully over the figure with an HHHHH pencil, and it is ready for colouring.

To draw architectural canopy work true to style and date requires the study of years, but there is a royal road open to every one, and that is to copy examples of existing ancient work, or even some of the very beautiful drawings of modern artists, who have travelled and studied in many countries, and brought their art to great perfection.

Those who wish to take up glass painting should, when on a visit to any part where stained glass may be seen, and it is almost everywhere, take their sketch or pocket book and note down bits of canopy work—crockets, finials, pendants, shafts, bases, and enrichments—and in time they will, from the fragments, be enabled to build up beautiful work, true to style and correct in colour and drawing.

Visits to the South Kensington and British Museum libraries will give an abundance of examples of the best work of all periods, and many towns and villages in England have examples of fair work that the novice (who has not the *entrée* to our national collections) may copy and profit from.

Having collected you details for a canopy, sketch it out as you did your figure, and in the same way transfer it to your paper, and pencil it in neatly and carefully. The shafting and base must be done in the same way, so that as a result you have an outline pencil drawing, in which your architectural work must be very carefully drawn, paying great attention to the main lines and masses, and giving but little heed to smaller details, which can afterwards be added with the pen.

For the style of colouring scarcely two artists adopt the same mode, and the consequence is a difference of technique, of tone, and of finished effect; but these are things which only concern the mature artist, the colourist of experience. As modes of colouring vary so much, all the methods cannot be explained, the writer will therefore simply place his own method on record, that others may alter, accept, adopt or reject as they please.

The pencil drawing being finished, cover the whole space of the design with a fairly full wash of a greenish-yellow tone (gamboge and Hooker's green No. 1), as near the tone of ancient glass as possible, and allow it to dry; this forms a warm ground, and gives a peculiarly luminous appearance and ivory tone to the drawing when finished. First take the canopy work in hand, and put in all the shaded portions with vandyke brown cooled with a bluish-green, deepening the shadows with a warm grey. When dry touch in the enrichments, which are to be stained, with gamboge and Indian yellow. For this particular figure of St. Paul we might colour it as follows: The cloak a warm white with a diapered pattern of stain (yellow) and black powdered entirely over it. The lining of the cloak a dullish green, a pale olive, and the under robe ruby. The nimbus, back, border of garment and shoes may be of varied stain—not too dark; the sword a grey white. For the curtain background we will choose a deep, dull, or brown yellow, treated with a black diaper. This will be a retreating colour, and cause the figure to stand boldly out, but it will not in the least clash with the stain shown on the figure or in the architectural work, being of a much deeper and sombre hue.

Let us give a few hints as to the mode of applying the colours and the tints required. The warm white for the cloak may be Indian yellow and Hooker's green No. 1, cooled in the deeper parts with Hooker's green No. 2, and a very little vandyke brown. This should be applied with some little regard to folds and the rounding of the figure. The green for lining may be modified with a little burnt sienna or umber. For ruby drapery the parts to be coloured should always be first coated with a strong wash of gamboge, which being allowed to dry thoroughly should receive a wash of crimson lake of very varying depth, to give as much resemblance as possible to the light and shade required in the drapery and the nature of the ruby glass from which the sections of drapery will be cut. In shading ruby use varying depths of madder brown, and for the deeper shadows vandyke brown. The ruby in a window should be used somewhat sparingly in most cases, but what is used should be skilfully varied, so that the light and dark parts come in the correct positions; for in the judicious usage of ruby, in jewel-like fragments, a poor window is frequently rendered a very passable one, while large masses would produce a tawdry, garish appearance. The curtain background may be of any deep yellow, varied by the admixture of burnt sienna, umber, and a little Indian red. The band at top of curtain and its fringe may be stain and white. The background of the canopy will be ruby, and of the base, where it shows in one or two small places, a varied greenish-blue. For the background behind the head of the figure, let it be a blue varying from a paleish to medium depth, and having a purplish hue in parts. It would bear a half tint diapered pattern. Variety in tone is the charm of a good window.

For shading the green drapery use green and vandyke brown, and as a rule, in putting in the folds of drapery, use the self colour of the drapery, mixed with a deep brown, to imitate the painting pigment used by glass painters upon the actual glass.

For the flesh put in all shadows with a warm grey—say burnt sienna, indigo and vandyke, using more or less, according to the depth of shadow required. To take from the green and sickly tone of death—a greenish straw tint, from which the glass for flesh is usually cut—a very delicate wash of light red is by some permitted, but by others such a proceeding would be tabooed; it would cause a very visible shudder. This question of flesh red is a moot point among modern glass painters, but as it was not introduced into England till about 1510 it should, strictly, not be used in imitating work ulterior to that date. Of course if one is imitating Early English, Decorated Flemish, or Swiss work, it is permissible to imitate the reddish flesh glass of the time, but it was rarely used during the sixteenth century, and therefore for Perpendicular work should not be used. Yet there are masters who paint very fine Perpendicular windows, and are not proof against using just a *soupçon* of Chinese red—just a film to take off that corpse-like pallor and differentiate between the similitude of warm, living flesh and the cold hue *of white drapery.*

When doctors disagree who shall decide?

Now our drawing is coloured, and the next step is to put in the lead lines with a pen charged with vandyke brown and burnt sienna. After that is completed dilute some of the same colour, and with a very fine pen add the details to the architectural work, give a little definition to the finials and crockets, add little windows, brackets, terminals and pinnacles; define the features and fingers, the nimbus, etc., of the Apostle, add a pattern to the border of the robe, a fringe to the curtain, etc., and generally bring out what has before only been indicated. When this has been done it will be found that the general appearance of the colouring is weak; this is from the contrast of the dark lead lines and the ornament you have introduced. You must therefore carefully go over the design again, adding depth where required, until you arrive at the goal of every art worker—a noble one, but difficult to reach—perfection. Let us look a little further into colour as applied to stained glass. Purple is broadly divided into two kinds, red purple and blue purple, which are each again split up into an infinity of different shades. For rendition on paper the former may be composed of carmine or crimson lake and Prussian blue, both of them transparent colours, which may be varied by the admixture of a little burnt sienna, madder brown or Indian red. For blue purple use crimson lake and Prussian blue, or cobalt cooled with indigo. Thus you may obtain every shade in red purple from cinnamon to deep claret, and from lilac to the Tyrian purple of ancient Rome.

For obtaining a correct idea of colouring nothing will give clearer insight than the study of genuine old glass, and by so doing the student will find that gaudiness and beauty have no affinity or harmony. Loud tones and violent contrasts may catch the vulgar eye, and cause the uneducated tongue to wag out an automatically uttered "How beautiful!" but the study of old glass will cause the student to note the peace and restfulness of quiet and subdued colouring, enriched by little gems of bright and cheerful glass, such as one sees in mediæval work of the best period. Subdued does not mean sad, nor quiet colouring gloomy; one may have richness without vulgarity, and warmth without glare; variety, and yet harmony and brilliance, without garishness.

Another point is the amount of "colour" and the amount of "white" glass in a good window, and there again examples must guide the draughtsman—examples of existent ancient work; for coloured drawings or prints are of little or no use to the true art student who wishes to produce not a pretty bit of colouring, but a correct specimen, true to the period and style of the glass he wishes to represent. Something of the quality and amount of colour introduced in old windows may be gathered from the Short History of Stained Glass in the first chapter of this book.

The colourist will remember that when we view a window from the body of the church we wish to see harmony of colour, whether it be pale or rich in tone, or whether much or little colour is introduced; but if a flaming patch of red, or a cabbage green, or wash-tub blue be presented to our gaze the trained eye at once detects it, the mind is fixed upon it, and the rest of the colouring being "in place" is not noticed. It is only the obnoxious pieces of gaudy and harsh colour which rivet the attention and send thrills of aversion over one's whole being.

No colour should stand forth from the window so as to be observable at the first *coup d'œil,* but should be so toned and qualified that each colour takes its place naturally and appropriately, so that no vulgar glaring colour may hurl itself at the observer, as was the case with the windows of thirty or forty years ago.

Many windows of the fourteenth century are composed of more than two-thirds coloured glass, while many of those of the fifteenth and sixteenth centuries show only about one-fifth colour to four-fifths white glass.

Just a word as to "white" glass. Such glass does not exist in the glass painter's racks; that is, a glass which is absolutely colourless.

To a stained glass artist every particle of glass must have a tone, be it of a greenish, yellowish or cold tinge. Of white glass, so-called, there are some scores of tints, and different artists have different notions of the various tones which should be used for different work, a matter we will speak more fully upon under "Cutting".

When your design is fully coloured you may, if you wish, wash it completely over—but very carefully—with mucilage made from pure gum arabic, melted in cold water, and kept closely bottled. This gives great brilliance to the colours of the design, and imparts to it a metallic lustre or glassy appearance, which some artists approve of, while others look upon it as a kind of trick.

For mounting the design proceed thus: Round the broad black margin of your drawing, at the distance of an eighth of an inch, run a fairly thick line, and just outside that again a thin one. Next, at a distance of three-quarters of an inch, run a pencil line, and to that pencil line cut a Gothic headed mount out of grey or silurian tinted mounting board. Paste your design on another piece of cardboard, place the mount over it, and the work is complete.

If you cannot handle a knife sufficiently well to cut a mount, take a pair of scissors and cut through the pencil line surrounding your drawing, and carefully damp the back of the drawing—very slightly—and fasten it upon the surface of the tinted mounting board with paste or ordinary gum.

The cheapest and best framing is to lay the design between two thicknesses of thin window glass, and solder a broad lead round it. Then by soldering a couple of copper wire loops at the corners it can be hung anywhere, and remain free from soiling during the cutting, painting and glazing of the window. The lead frame may be brushed over with gold paint or Brunswick black, or painted to suit any individual taste.

We have simply shown how to make one small design, but it will serve to give the student the *modus operandi* for larger and more complicated windows.

FIG. 6.—Cologne Cathedral, 1530.

DIRECTOR OF INDUSTRIES. LIBRARY. 4-SEP 1923 BENGAL.

CHAPTER III.

CARTOONS AND THE OUTLINE.

HAVING completed the small design or scale drawing, the next step is to commence the full-sized working drawing or cartoon. Why it is called a cartoon is probably to distinguish it from drawings on linen, canvas or other materials, as it is said to be derived from the Latin, *carta*—paper.

The cartoon paper may be purchased by the yard at most of the leading artists' colour dealers or stationers. It is in continuous rolls, thirty-six and fifty-four inches wide, and may be had either in thick or thin quality, fine or coarse grained. The price varies from fourpence to one shilling per linear yard. For large figures the thick kind of cartoon paper should be chosen, while for small figures, canopies, bases and other ornamental work, the thin variety will be found best adapted. If the drawings are not to be more than two feet square, "Whatman's" or stout cartridge paper may be used. Cartoon paper takes colour fairly well, but is of a somewhat absorbent nature. The work may be drawn in chalk, charcoal, sepia or bistre. Each has its distinctive advantages; thus for large, bold figure work the quickest is charcoal, as big shadows may be rubbed in with a wash-leather in a very effective and expeditious manner.

Chalk is a medium giving fine black and white results, but is not so quick a medium to work with, and not readily rubbed out for alterations or amendments.

Sepia and bistre are both pleasant to work in, and for facility there is nothing to choose between them, the only difference is that while sepia gives a blackish-brown tone to the work, bistre gives a warm effect and is liked by many. Either may be used for ornament and small figures or subjects.

CHARCOAL CARTOONS.

The drawings of a generation ago were made upon paper, which was first liberally brushed over with ordinary house-painters' size. Upon this the figure was drawn, outlined and shaded, after which the paper was hung against a wall and steamed. This was done by a boy armed with a tin coffee-pot arrangement with a long spout, the end of which was flattened and spread out so as to present an orifice four or five inches wide.

The upper part was filled with water and the lower section contained a spirit lamp. Steam having been got up the boy held the spout close to the cartoon, going entirely over it, bit by bit, steaming the cartoon from top to bottom. This process melted the size, which in its wet state absorbed the charcoal; but upon cooling it formed a glaze over the drawing and so rendered it proof against being smeared or rubbed. This process of steaming is now but little used, although its cost is infinitesimal.

A fixative is now used which is very effective and very quick to work with. It may be bought at any colourman's, or may be made by melting resin in methylated spirit. It is used with a vaporiser such as ladies use for the diffusion of perfumes. The cartoon is simply sprayed or blown all over with the fixative, which acts very effectively in adhering the charcoal to the paper. The spirit evaporates and leaves an almost invisible coat of the resinous compound upon the drawing which acts as a kind of varnish in preserving the charcoal from smearing. The charcoal used for these drawings should be what is known as "vine charcoal," which is made from vine stems in the wine district of France.

Chalk drawings are made with ordinary black Conté crayons Nos. 1, 2 and 3, the hard being used for delicate lines, and the soft for broader lines, shadows, etc.

Many artists outline in chalk and put in the shadows with powdered charcoal, which is sold, finely ground, in bottles. This powder may be applied with a short-haired brush, a piece of wash-leather, or an ordinary stump. The tip of the forefinger is also an excellent tool for the modulation and toning off of broad or sweeping shadows, folds of drapery, etc. Of course when a "fixative" is used it is not necessary to size or prepare the paper in any way, but care should be taken to choose a paper with a good grain, otherwise, if a smooth surface be used, a dirty smear will often be the result instead of a well-graduated shadow. When a drawing is made entirely in chalk, or even with well-rubbed-in charcoal, it may be fixed by passing through a bath of milk and water, equal proportions of each.

Sepia drawings present the fewest difficulties to beginners, as the colour can be spread, washed in, washed off, and graduated with little difficulty, and present a finished appearance when completed. Any amount of detail can be worked in, diapered patterns shown, and the parts to be stained coloured yellow with charming effect.

With sepia drawings most of our readers are familiar, but as chalk drawings by celebrated artists are seldom seen they will pardon us if we mention the noble chalk cartoons of Raphael to be seen in one of the upper galleries of the Victoria and Albert Museum, Kensington. They are coloured cartoons, and as perfect as when they left the artist's studio 400 years ago.

Another grand chalk cartoon may be seen any day at the

Gibson Diploma Gallery, Burlington House, Piccadilly, which is open free to the public at stated hours. It is the immense cartoon by Daniel Maclise, R.A., representing "The meeting of Wellington and Blucher on the field of Waterloo," an historic event which did not take place; nevertheless the drawing loses nothing by the historical inaccuracy, but being one of the finest chalk drawings in existence, should be seen and studied by all cartoonists. The oil painting, or fresco, executed from the cartoon is in the House of Commons.

Chalk is not so easily smeared or spoiled as charcoal, but needs fixing, which may either be done by the milk process or by having a double coating of fixative blown over it. The second blowing should not take place till the first is thoroughly dry.

Let us endeavour to make a cartoon of St. Paul from our small design, which, it will be remembered, we left glazed and in a leaden frame.

Our full-sized figure is to be three feet high.

We fasten a suitable length of cartoon paper on our easel —any ordinary easel with a long drawing board, say four feet by two feet, placed upon it—and mark a faint central line from top to bottom, and also mark off a space on the line three feet high: this we divide into twelve sections, through which we rule horizontal lines; also at distances of three inches apart we rule vertical lines, three on each side of the central line.

We have now a space three feet high by one foot six inches wide, ruled off into three-inch squares, upon which to draw our figure.

We next take the small design and with a fine mapping pen filled with Indian ink or umber rule a central line upon the glass down the centre of the design. This we flank with lines a quarter of an inch apart, and after making horizontal lines above the Apostle's head and beneath his feet, proceed to divide the intervening space into twelve sections, which we rule neatly with fine lines.

We now have the figure spaced out into little squares of a quarter of an inch in diameter, just as we have our cartoon paper squared up into three-inch spaces.

Commencing with the head, we gradually block out the whole figure upon the paper, enlarging on the cartoon paper, block for block, just what we see in the small design.

For this purpose a thin stick of vine charcoal should be used, as it is so easily dusted off with a piece of wash-leather or soft linen.

Having blocked out the shape of the head, hands, sword and each mass of drapery, carefully dust off the charcoal so as to leave but a faint remainder, and proceed to put in the features and folds of drapery, etc., with a lead pencil. Use the pencil lightly, as it will not be rubbed out, and yet does not want to be seen in the finished cartoon.

At this stage the lines of leading should be introduced. This must be done judiciously, so as to help and strengthen the outline and give grace to the figure, and should be so arranged as to be scarcely seen in the actual window. The lead lines must be made to form part of the design of the window, not merely as ugly vehicles for holding the component parts together.

Easy curves around the various sections of glass must be shown, and abrupt angles or breaks must form no part of the scheme. Deep recesses or "bays" in the glass must not be shown, as such are very difficult for the glazier to cut, and are an absolute source of weakness to the window, such deep curves being apt to be broken by the force of the wind during gales.

Look at the figure of St. Paul in the illustration, and scarcely any lead lines will be seen without they are looked for, yet the figure is in upwards of sixty pieces, and will be twice crossed by iron saddle-bars for fixing, behind which other lead lines may be placed when the glass happens to be in large pieces.

The lead lines may be shown a quarter of an inch broad, and may be put in with umber and Indian ink, or with any deep solid brown. When the lead lines are dry proceed to draw the figure, section by section, in sepia, first indicating the principal lines and folds of the drapery, the book, sword, and other details, and when these are shown in outline then commence to put in the shadows and folds, using larger brushes. Flat camel-hair brushes will perhaps be best. The head and hands should be left till last, as they require more careful handling and more attention than the drapery. As a rule, hands put in from the artist's imagination are usually very stiff and faulty, recourse should therefore be had to a model—one s wife, children, or friends are usually handy, and will stand as model very willingly. If such models are not to be had at the moment, one must do the best he can with his own hands, seen in a conveniently placed looking-glass. The shading need not be so deep as in natural folds of drapery, for it must be remembered the cartoon is only to serve as a guide to the glass painter, and not to be considered a highly finished drawing. The pattern on the nimbus should be shown, also the border of the outer garment indicated, and the cartoon is complete.

It is seldom that a cartoon is coloured, but should it be desired, the colours may be put in after the lead pencil stage, and due regard should be given to light and shade in this matter, and to the general rounding of the figure.

Although colouring cartoons is a practice seldom indulged in by English artists, yet it is frequently done on the Continent, and certainly gives a wonderfully enhanced effect at a very little cost either in time or colour. A little of the latter goes a long way in thin washes. English artists are usually content with the black and white cartoon, the coloured design, and the wealth and beauty of modern antique glass from which to make their windows, looking upon the colouring of cartoons as "of no earthly good"—a mere work of supererogation; besides which, black and white cartoons are easier to paint from.

It sometimes happens that a window is required in a great hurry. It has to be unveiled on a certain day, or the donor is going abroad, and would like to see it before starting on the journey. In such cases many excellent windows have been simply roughed out in charcoal—a mere outline; but in the hands of clever glass painters the window turns out very successfully.

It takes a glass painter some time to learn to interpret the style of a certain draughtsman, but when that style and touch is mastered the work becomes much more interesting and rapid. For this reason painters like to keep as much to one draughtsman as possible, and are frequently somewhat abroad when they are suddenly called upon to paint from another draughtsman's cartoons. Cartoons should therefore be well drawn—crisp, crumpled folds, or swinging, graceful lines well balanced, characteristic heads, flowing hair, and delicate, well-drawn hands, and *carte blanche* given to the painter to amend, improve or alter where he thinks advisable. Many draughtsmen will not allow these liberties, and require their work to be reproduced line for line and touch for touch; but given a clever painter, much improvement may be shown upon the most carefully drawn cartoon when the figure is on the easel, and the accidents of colour, shade and texture of the glass can be taken into account by the painter, to the great improvement of the panel in hand. Two heads are better than one.

As a rule figures are somewhat clumsily clothed in drapery, which is again overburdened with a multitude of folds, many of which might be left out, by which excision the figure would gain in elegance, simplicity and breadth. A redundancy of folds, as a rule, marks incapacity in the draughtsman.

Study early work whether in glass, canvas, stone or even brass, and note the few folds of drapery required by a really clever artist to portray an elegant figure.

To this end the draughtsman for stained glass might obtain much assistance by studying some of the church brasses of the fourteenth and fifteenth centuries, in which dignity, breadth and grace are obtained in marvellously few lines. Yet on looking at such a brass as here represented it would be difficult to say where a single line might be added which would help the figure or give any greater charm than it already possesses.

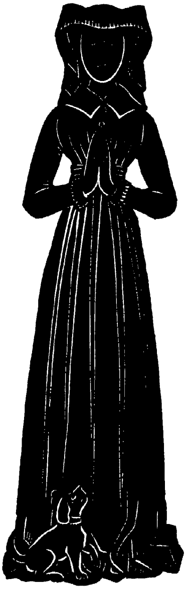


Fig. 7 16th Century Brass

Subject cartoons are drawn in precisely the same manner as when a single figure is desired, only greater care is required in the grouping and the introduction of accessories, or what a stage manager might term "properties".

To draw a figure well is an enviable art, but to be able to create and draw subject windows with originality and correctness is a crowning achievement of skill possessed by but few, and requires much study.

Costume of various periods, armour, architecture, and the manners and customs of the epoch represented must all be in the knowledge of the draughtsman, or vexing anachronisms will be perpetrated in glass which are much more difficult and costly to alter than in paintings on canvas.

We have spoken of figure drawing, we will now examine a little into the architectural work of the window we have taken in hand.

Cartoons for bases, shafts and canopies are invariably drawn in sepia, and there is but little difference in the mode of drawing them than in figure work. The paper is plotted out into the same little squares, and the small drawing is also squared up by lining the glass.

This lining upon the glass was an idea of the writer's, but many draughtsmen still follow the old routine of taking a careful tracing of whatever is to be drawn upon very transparent and thin tracing paper, and then lining it into squares with a pen and ink.

This process entails time, and may injure the design if a too sharp or hard pencil is used, or the design may be accidentally soiled; by the glass process, however, this is obviated. Again, in tracing anything much of the original feeling is lost, and lines and touches often missed.

Having squared up the paper, proceed to rough in the canopy, blocking it out in charcoal without any regard to detail.

That being satisfactorily done, carefully outline the various shafts and pinnacles, crockets and finials in pencil, leaving out, or merely indicating, the minor ornamentation and details, and proceed to put in the lead lines as you did for the figure, remembering that backgrounds are very obtrusive, and with that knowledge circumscribe their limits as much as possible. The canopy is the main idea, the background is an accessory—a necessary one certainly, but it must be kept as its name implies—in the background.

Much of the beauty of a canopy is brought about by the background, which throws it into relief, bringing out its beautiful tones of silver and gold, and acts as a dark setting to the pinnacled and crocketed work set upon it.

The shadows of the various members of architectural detail will next be put in, and that will bring forth the query, "Where shall I put my shadows and rounding up of the detail?" Usually a stained glass artist imagines his light to come from the top left-hand corner of his drawing—invariably so if it is figure or subject work—but for architectural and other ornamental work the "lighting" varies. For canopies the usual method is to imagine the light coming from the top left-hand corner of the paper, consequently everything must be shaded on the right side. Old glass painters did not always keep to this method, but sometimes shifted their point of light to the right-hand top corner, in which case the shadows fell to the left. Yet a third method, seen in many old windows, is to imagine a light in the centre of the canopy, and as the shadows would then naturally fall from the centre, the right half of the canopy would have the right side of all its details in shadow, and the left half its shadows to the left. Whichever way the canopy is shaded, the shafts and base must be treated in the same manner.

After the shading has been added, the canopy must be outlined in sepia, and every item of detail and enrichment added. Many draughtsmen put in their outline before shading, and are more certain of the position and depth of their shadows. If the shading is put in first it should be strengthened where necessary after outlining. The usual practice is to draw only half the canopy from a line drawn down its centre; and this to men used to such work is all that is necessary, but the amateur who is not quite sure of the balance of his work might be wise to draw the whole, as frequently what looks tall and graceful when only half is seen, turns out a very dumpy and ill-proportioned piece of work when the other half is added, and its breadth consequently doubled.

The next thing will be to tint in, with gamboge, Indian yellow and a little burnt sienna, every part which has to be stained with a golden stain when the pattern is painted on the actual glass. The stain should be varied, and only applied to the enrichments and little bits of detail, not to the actual members making up the structure of the canopy, shaft, or base as the case may be. Backgrounds of architectural work are either ruby or blue, but in rare instances green, purple, or yellow.

The beginner will do well to keep to the first two colours mentioned, and to use these colours sparingly, as they have an ugly knack of being too assertive—in other words, a little background goes a long way. To those wishing to draw this kind of work, who have had no previous experience, we may say do not try to evolve it from your own imagination or failure is inevitable.

Find out the nearest church or museum containing a genuine specimen or specimens of old glass, and ask permission to copy it. Such permission, on giving an assurance not to touch the glass for measurements, will never be refused, and after securing a few studies you will then be in a fair way to try one on your own behalf. The cathedral of your diocese is sure to contain many windows from which studies may be made, and permission to copy will invariably be given by applying to the Dean, who is custodian of the whole fabric during his time of office.

Unless you are perfectly sure that modern windows are good and true to style, do not copy them, or your ideas of date and style will become so confused that you will be unable to differentiate between Norman and Early English, Decorated and Perpendicular. The public libraries of large cities sometimes contain books which will help one in studying glass painting. Many books on archæological and antiquarian topics will be found to contain illustrations of old windows, which the librarian may give permission to copy. In these days of cycling, distant places are brought near, and the iron-horse may help us in our art studies by taking us with very little cost to places too far to tramp to on foot. Patience, practice, and perseverance are pertinent points in all art productions.

Michael Angelo one day, in the presence of his employer, the Pope, took such trifling particles off the nose of a statue he was at work upon that the Pope asked impatiently, "Why waste time on such trifles?" To which the great sculptor replied, "They are trifles, I admit, but trifles make perfection, and that, your holiness, is no trifle!"

THE CUTLINE.

Having made our design and cartoons, we will advance our window a step further. We wish to cut our glass for painting upon, but before we can do so we must have what is called a cutline, which is a working drawing for the glazier, just as a cartoon is a working drawing for the painter.

A cutline is a drawing or plan showing the size, colour and shape of every piece of glass of which a window is composed, and is a diagram for the glazier first to cut his glass upon, and subsequently to glaze every individual piece upon after it has been painted and fired.

Cutlines may be made either on white lining paper or tracing cloth. Tracing cloth is a kind of glazed and transparent linen, sold in rolls about twenty-five yards long, and thirty and thirty-six inches wide, the former costing 9d. and the latter 1s. per yard; any length can be supplied from the roll.

Lining paper may be procured at any paperhanger's, of various qualities and widths. The narrowest is twenty-two inches, the next thirty inches and thirty-six inches, and the widest forty-eight inches.

The narrowest is wide enough for ordinary work, as windows are mostly not more than twenty inches wide, very few exceeding twenty-seven inches, for which thirty-inch lining paper would be required.

To make a cutline whether on paper or on cloth the first thing is to lay the material on the work board, fasten it down with drawing pins, set out the exact dimensions of the window in hand, and see that the shape of the stonework head of the window is accurately drawn, otherwise a bad fit will result when the window is fixed. A central line should be run from apex to sill of the window space.

Now upon this paper carefully place the half canopy, and, after adjusting it to the centre line, place under it sheets of black transfer paper (size about twenty-two inches by eighteen inches), and having fastened all down take a skewer-shaped stylus of hard wood and firmly trace over every lead line shown in the drawing of the canopy, so that it may mark through the black transfer paper and leave an indelible line to the exact shape to which every piece of glass has to be cut.

When the half canopy has been gone over, do the same with the shafting and half base, being careful not to miss a line, nor to commence till the drawing is absolutely in its correct place.

This being done, remove the drawing and transfer paper and you will have a fine firm network of lines—lines which represent the shape every piece of glass has to be cut to, and the exact place where every lead must hold it to form part of, and to build up, the resultant window.

Take out the drawing pins and fold the paper, on itself, down the central line backwards, and, laying the black transfer paper under it, go over all the lead lines with the stylus. This will give you a replica on the other side of the central line when the paper is unfolded and laid out flat, so that you now have the complete canopy, both shafts and the whole base, leaving a blank space in the centre for the figure of St. Paul.

The cutline being again spread out and fastened to the board, the cartoon of the Apostle must be laid accurately in its place, and all the lead lines gone over with the stylus; after which you will have a complete "cutline" (or glazier's drawing) for cutting and leading upon.

Tracing cloth is much dearer than lining paper, but very much less liable to tear with the constant moving about in cutting the glass and other operations, and, being transparent, the cutline is more quickly made by using pen and ink or a fine camel-hair brush dipped in Stephen's ebony stain, which should be diluted with an equal quantity of water.

There is our cutline, now for colouring it.

This is best done with ink applied with either a pen or a small camel-hair pencil.

Hang the small design in a handy place over your work board, and commencing at the top place letters to represent colours in every section shown on the cutline.

All the architectural parts will be marked A W antique white. The background of canopy, R ruby; the background of figure (around the head), B blue, and so, looking closely at the small design, every piece must be "coloured" on the cutline.

The usual lettering is as follows:—

Antique White = A W
Ruby = R
Green = G^{n}
Grey = G^{y}

Blue = B
Black = B^{k}
Yellow = Yell
Orange = O^{rg}

Blue Purple = B P^{l}
Red Purple = R P^{l}
Brown = B^{n}
Cold White = S^{t} (steel)

These signs are prefaced at times with the signs for warm = W^{m}, or C^{d} = cold. Thus C^{d} G^{n} would mean cold green, W^{m} G^{y} would be warm grey.

Or the lettering may be doubled as: G^{y} B = grey blue, or Yell G^{n} = yellow green, or B^{n} R P^{l} = brown red purple—that is, purple of a chocolate hue.

Sometimes ruby is marked R on B or R on W, which means ruby on blue or ruby on white—that is, ruby flashed upon blue or upon white glass, a thing which will be explained under the heading "Glass".

From this kind of window, being constructed of scores of pieces of variously coloured glass, the style is what is called "mosaic" stained glass, to distinguish it from "enamel work," which is composed principally of white glass "enamelled" or painted with various oxides mixed with a flux, which being fired causes the different colours to adhere to the glass, and gives it somewhat the appearance of painting in ordinary oil colours.

For setting out outlines of quarry and geometric lights several tools, etc., will be required, among them a few common deal laths 2 inches wide and a ¼ inch thick, and in length of, say, 8, 6, 4 and 3 feet; a T-square with a 24-inch blade; a pair of compasses a foot long when closed, and with a leg for a pencil; a 3-foot straight rule marked in inches; drawing pins, a box of mathematical instruments, black chalks or Conté crayons, tracing and transfer paper, etc., etc.

Outlines for geometrical and foliated panels should first be set out in pencil, and afterwards finished in ink or black chalk.

Some geometrical patterns are very beautiful, others fanciful; some being very simple, while others are veritable puzzles to set out.

As a rule, the groundwork of all geometrical patterns is the square and the circle, and however intricate the design may seem, it will be found on close study to resolve itself into these figures, from which spring curves, oblongs and other geometric forms.

Study till you discover the ground lines of the pattern, then proceed to plan out these lines upon your paper in pencil, and from these fundamental lines proceed with parallel rule and compasses to work in your pattern, remembering that glass cannot be cut into nooks and angles with the same facility as a piece of paper or cardboard.

Having marked the side line of a panel, place one of your deal laths on it and keep your T-square constantly working upon it to get all your cross lines true and square, as geometrical work is nothing if not accurate.

FIG. 8.—From German Glass.

CHAPTER IV.

THE VARIOUS KINDS OF GLASS-CUTTING FOR WINDOWS.

Of the various kinds of glass used by the glass artist, but one only merits our attention, *viz.*, antique glass, though in modern workshops many other kinds will be found for purposes of plain glazing, for quarry work, geometrical and foliated windows, door and window screens.

We will look at some of the varieties.

Flashed Sheet Glass.—This is thin in substance, flat and gaudy in colour, and made only in ruby, amber, blue and green. It is used in conservatories and cheap houses, the buyers of which are content to accept tawdriness for beauty.

Fluted Glass—always white—is a wavy or striated sheet glass, and has the peculiar property of being impervious to the vision whilst obscuring very little more light than would be the case with clear window glass. When cut up into squares or quarries and leaded with a narrow line of ruby or other colour, and an outer margin of white glass, it has a very clean silvery effect, and if the "flutes" are cut at different angles, so as to catch the light, has a very brilliant appearance.

Muffled Glass is not obscure as the name would imply, but of a bright translucent nature. Its surface is of a hilly-holey, hammered nature, and objects behind it cannot be discerned. When leaded into geometrical designs it is useful for hall doors, bath-rooms, or to hide brick walls or ugly views without obscuring the light. It is made in many artistic tones of pale green, salmon, grey and yellow.

Rolled Cathedral Glass is used principally for plain or ornamental glazing in churches and public buildings. It is about an eighth of an inch in thickness, not very level in surface, obscured on one side and plain on the other. It is made in scores of different tints from pure white to maroon, from lemon tint to deep orange, from the tenderest green white to dark olive. It is a strong glass, easy to cut, and will in the paler tones take a beautiful stain. Many cheap windows of grisaille and painted quarry work are made with it, and it has the merit of being both inexpensive and durable. Its flatness of colouring and semi-opacity are against it from the glass painter's standpoint—it lacks brilliancy.

Sanded Sheet Glass is not now much used. It is made in a variety of colours, but is usually poor in substance and very flat in colour. It is very useful, however, for lines and borders round window screens and door panels, also for foliated work it makes very pretty panels. The various tones of green and brown, when cut into leaves and stems, and placed on a pale yellow background, have a really charming effect if the pattern is drawn by an expert hand instead of the glazier, whose skill, although great in cutting and leading, is totally inadequate to the production of anything more than stiff, spiky leaves set on cast-iron stems. The ordinary glazier's colouring is often very artistic and tasteful, but his drawing, it has been said, " would make a blind man squint ". Every man to his trade !

Ambetty Sheet.—This we may almost term the amateur glass painter's friend, as it comes next to antique glass for its suitability for painting and staining purposes. It is fairly thick in substance, not too transparent, having a surface from absolutely rough to just marred enough to make it a near rival to antique glass. It is brilliant and translucent.

Some of it is minutely speckled or "seeded" like antique glass, and being of uniform thickness there is but little waste in cutting, a remark which will unfortunately not apply to antique glass. It is made in a variety of pale tints of yellow and green, and has the merit of being only half the price of "antique".

Venetian Glass.—This is really "antique" glass of a peculiar appearance, each sheet being rolled into a series of diagonal "pits," which catch the falling light when the glass is set on edge, and gives it a very brilliant appearance. It is very difficult to cut; so unequal in substance when cut that it is difficult to lead, and very expensive. These considerations should cause the amateur glazier to leave it severely alone.

Opalescent Glass.—As its name indicates, the colours of this glass are of an iridescent nature, the metal itself having an opal texture. It is nearly opaque, and appears to be the connecting link between glass and marble or alabaster. To see its beauties, and it has many, one must look on the surface rather than through it, as one would do with a real glass. It is beautiful, but expensive. This is very extensively used in America, but its expense limits its use in England.

Norman Glass is a new make of glass, identical in texture, colour and appearance to the glass made between 1100 and 1250, and is principally intended for plain geometrical glazing for churches or municipal buildings. It certainly has a very fine appearance and is easy to cut. It is made in slabs about 5½ inches by 3½ inches.

There are many other varieties of glass, but they neither concern the glass painter nor glazier to any extent, and may only be mentioned by name without remark. Muranese, daisy, pyramidical, rippled, granulated, sandblast, ground, matted and ribbed being among the number.

Antique Glass.—Forty years ago the only available glass for purposes of glass painting was not only poor, but it was absolutely bad. Not only was it garish in colour, but it was flat and uniform in tone, harsh and unqualified in its brightness, thin in texture, and fragile in its make; but on such glass the painters up to the sixties had to paint their work. The consequence was that, however beautiful their drawing might be, and however well their work might be painted, the effect produced could not possibly be good, because the very foundation of their work was so terribly bad.

One "cannot make a silk purse from a sow's ear," neither could the glass painter of the first two-thirds of the nineteenth century revival "make his bricks without straw," nor produce a satisfactory window representing the glories of fifteenth century work on nineteenth century glass. Being cognisant of this fact, certain clever glass makers set to work with the assistance of expert analytical chemists to discover the ingredients, the ratio, and the component parts of mediæval glass.

After long study, and a great many experiments and trials, the secret was fathomed, and "antique" glass—that is, glass similar to that of the best period of glass painting—became an established fact, so that at the present day two or three English makers produce glass for painting upon which is equal to anything ever made, either in this country or abroad. The varying thickness, the beautiful gradations of tint, the brilliant texture, the fine colouring, the strength, the translucence, are all to be found in the modern antique glass, while the number of tints made are so many as to be practically illimitable. The tone, the texture, the seeding, the marking, the want of flatness of the sheet, the selvedge edges are all there, and all accurately copied. We will run through the list of colours, making a few notes on each.

Ruby.—This comes first, as it is at the same time the most beautiful and the most costly glass, and exerts the most influence in the making or marring of a window. Like other antique glass, it is made in sheets about twenty-four inches long by sixteen inches wide. The sides are selvedged, but the ends are cut. Each sheet varies in thickness from one-sixteenth of an inch to a quarter of an inch, while in tone no two sheets are alike, varying exceedingly in the colour, which from a rose tint frequently runs through all the gamut of red tones to an almost opaque black ruby. What is termed ruby glass is really of two thicknesses, the "body" of the glass being of a pale tone, "flashed" or coated with a very thin film or veneer of ruby, which is so fused to the under glass as to be practically part and parcel of it, just as a man's skin covers, and is practically part of, his flesh.

The glass upon which ruby is flashed is not always white, but is sometimes of a greenish tone, a yellow, or even pale blue. The first gives a somewhat subdued tone of ruby; the second a rich, full tone, and the blue a qualified, subdued purplish tone, very useful for drapery for back figures or where heavy colouring is desired.

Plated on pure white glass the tone is of a scarlet or blood colour, and is the glass most used for ordinary work, being only half the price of ruby on blue or yellow.

Early glass was remarkable for the thickness of the ruby "flash"; indeed in the twelfth and thirteenth centuries it formed quite half the thickness of the glass, and was very streaky and blemished in appearance. Gradually succeeding centuries reduced the thickness of the "flash" without reducing the depth of colour, until, in the sixteenth century, the "flash" was not more than a twentieth of an inch thick, while at the present day it is frequently not more than a thirty-second part of an inch in depth.

Ruby of the genuine English make can always be relied on for firing, but Continental ruby flakes, cracks and chips, and is not worth painting upon, not only because of its liability to these defects, but because it has not the tone and variety of English glass.

Blue.—This is made usually as a "pot metal"—that is, it is of the same colour all through; and the same remark applies to nearly all other kinds of glass, whether green, yellow or purple.

The colouring of the blue glass is frequently very beautiful, and runs through every tone of "true blue," from the palest grey to the deepest indigo. Where a certain proportion of red is incorporated with it, it takes hues varying from the palest lilac to the deepest "regal" or imperial blue; and where green is mixed with it whilst in a molten state, runs from the most delicate turquoise to the deepest green blue merging on black.

It must be noted, however, that "flashed" blue is made and may be obtained for staining purposes, so that most beautiful green diapered patterns may be stained on the back of the blue glass, giving an exceedingly rich appearance to draperies.

When the sky is cut out of "staining" blue, landscapes, trees, cities, etc., can be painted and stained on the lower parts with very beautiful effect without the use of enamels, which twentieth century artists use only on very rare occasions.

Green.—This is made in every shade from almost yellow to deep blue green, and is always "pot" metal.

It is true that a flashed green is made, but it is seldom used, as stained blue answers every purpose for the art of the glass painter, except perhaps it be for an occasional piece of heraldry, as, for instance, argent on vert, an effect which is obtained by means of aciding off the green flash and leaving the white under glass.

Brown.—There are scores of shades of brown, running from pale cinnamon to sepia, russet to the verge of purple, pinkish tone to madder, and many more. Kept on the warm side, it is a very valuable aid to a window, linking or separating the primary and sharper colours according to the shade employed.

Yellow.—For draperies, curtains and architectural enrichments this is another valuable glass. It is made in a variety of colours, according to the purpose for which it is to be employed—palest lemon to deepest citron, or light gold to orange.

For drapery tints of silken texture glass may be selected which, when charged with black diaper, either sparsely powdered on or more generally covered in the manner of brocade, has a remarkably handsome and rich effect.

For curtains, and draperies for back figures, a deep tone is made, which is a retiring colour, and eminently suitable for the purpose.

White.—The term "white" is a generic one, embracing almost all pale tones until they become so deep as to call for a separate denomination. Thus, to the stained glass artist pale tints of grey, pink, yellow and green are all known as "white," but are termed Y W = yellow white, G W = green white, etc.

White of some tint was probably the first glass, made of sand, soda and seaweed, if we may trust the old story of the shipwrecked Phœnician merchants who are said to have first discovered it (like most other discoveries) in an accidental manner, though other traditions give the honour to the Chinese some 2,300 years before Christ. Egyptologists, again, tell us that the Egyptians made beads and jewels of coloured glass 4,000 years before the Christian era.

White glass was greatly in vogue in the twelfth century, and a document is in existence, which is really an edict of the Cistercian Order, restricting the glazing of the windows in their religious houses to white glass, that being the distinctive colour of the Order.

From the twelfth to the end of the fourteenth century there was a great difference in the glass made in the north of England and that of the south. That in the north was fairly regular in substance and very pale, almost pure white; while that made in the south and west was very irregular in thickness and of a green-blue tone, varying in depth according as the glass was thin or thick.

Modern painters usually chose for their "white" a warm greenish tone, which may be had of varying depth—the pale for flesh, and the darker for drapery, etc.

It may safely be said if a modern window is not beautiful it is no fault of the glassmaker, nor of the cutter and glazier, but the blame must lie with the painter or draughtsman who has charge of the "colouring". In large firms the master-mind is that of the draughtsman who makes the small coloured design; in private studios the artist is often his own draughtsman and painter combined, and in some cases he selects his own glass and cuts it with his own hands, in which case little gems of windows often result.

Given the splendid glass of the present day, there is no excuse for the mediocre and even bad work which so frequently disfigures our churches.

From the foregoing remarks the art worker should have gained an exact conception of the meaning of the three terms, "pot metal," "flashed," and "white," and as these words will re-occur it will be as well to keep them in mind.

CUTTING GLASS FOR WINDOWS.

Upon the skilful selection of the many pieces of glass which go to make up a stained glass window the result of its final appearance depends.

Let us peep into a modern cutting-room. Under the windows, so as to obtain a good light without the direct rays of the sun shining in, we see benches of about six feet in length, three feet high and two feet six inches wide—just plain, thick deal upon four strong legs. On the wall are pegs to hold cutting-laths of various lengths, compasses, T-square, etc. Round the walls of the room are racks for holding the various sheets of white and coloured glass. They are like wine bins—a series of reticulated spaces from floor to ceiling, about two feet deep, one foot six inches high, and one foot wide, each ticketed with a number.

Now, if we look to one of the windows we shall see what is called a "pattern card" suspended before it—that is, a leaded panel of glass consisting of a great number of oblong pieces of glass, each about two inches by one inch—having a number scratched or labelled upon it. These are fragments or samples of the glass contained in the various racks around the room, so that the cutter who requires a certain tint has only to look on his pattern card and note the number of the tint required, when he can walk to the corresponding number on the racks and select a sheet from which to cut the particular piece of drapery or whatever he may have in hand.

Upon the glazing board will be found the following tools: a hammer, a rule, a broad-nosed pair of pliers, a narrow-nosed pair of pliers, a glazier's diamond, two- or three-wheel diamonds, a small T-square, a large and small set-square, two or three cutting laths from one foot to three feet long, a pounce bag, a duster, a hand-brush, nails, and soldering iron.

The pliers are for grozing or breaking the glass at the diamond cut, the broad for straight cuts, and the narrow for awkward corners, curves, indentations, etc. The diamond is the chief cutting instrument, but the wheel cutters are very useful for rough or very uneven glass. The laths should be of hard wood—oak, pear or lance wood—a bare quarter inch thick, and one and a half inches wide.

A pounce bag may be made of some loose material, such as part of an old stocking, filled with perfectly dry sifted whiting. Cut a circular piece of the material six inches in diameter, place on it a heap of whiting and tie it up as a housewife does a pudding, so as to form a ball as large as a Tangerine orange, leaving the loose ends to form a handle. The pounce is for use when the glass is too dark to see the outline through. The uses of the other articles mentioned are self-evident.

We commence our window by cutting the architectural portions first, reserving the figure till the last. Take the canopy first and select a sheet of warm green-white glass of pronounced tone, and laying a piece upon the outline suitable in size to cut the largest piece of the canopy, cut carefully over it with the diamond, a task which requires some skill.

We will presume that before cutting up antique glass you have had plenty of practice at cutting odd pieces of window glass, or disappointment, expense and trouble will be the result. No two diamonds cut alike, and by practice only can the correct method be obtained.

Take a piece of common window glass, and get the cutting angle of your diamond by repeated trials of slope of the handle, till you find the best angle for cutting. Having found that, practise at that angle, and at that angle only, remembering that whatever position you place your hand, arm and body in the angle of the handle of the diamond must not be altered. Practise straight cuts first, and remember to keep the angle of the diamond the same right through the stroke, however long the stroke may be.

Having become proficient in straight cuts, practise curves, angles, circles and odd shapes, or, as it is called, freehand cutting. When you can manage these with certainty you may commence with antique glass, but not before.

To resume our canopy. Lay the piece of glass on the cutline over the particular section to be cut, and carefully go over the black line with the diamond, just as you would in using a child's drawing slate, but instead of cutting accurately over the centre of the line cut a fraction—a twentieth part of an inch—*inside* the line, so as to allow for the thickness of the heart of the lead in glazing. Having cut the glass, tap gently on the back of the cut with the block of the diamond, when the cut will "run," and this must be followed till the glass has been separated all round. The pieces not required must then be broken off. Where the glass is rugged, or has not quite broken to the cut, the pliers must be used to "groze" off the odd pieces. Hold the glass in the left hand, and taking the piece to be removed in the jaws of the pliers, bend the right hand down, breaking away the edge of the glass, which must not be nipped by the pliers. Grozing means opening the jaws of the pliers sufficiently wide to take the edge off the glass, then, maintaining the width of the opening, to break off the required piece of glass by a series of adroit movements of the right wrist. Do not try to break it off all at once, but little by little. Curves must be approached by "sapping". Suppose a half circle of glass has to be removed, you must first cut the semicircle as at A, and afterwards put in segmental cuts as shown in Fig. 9. These must be tapped with the

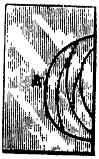


FIG. 9.

diamond block and afterwards removed, piece by piece, with the pliers.

Suppose we have to cut a piece to the shape of B, we lay the piece of glass over the outline and cut the pattern required, B, next we cut "easing" lines at EEEE, and others running to the edge of the glass, which gives us easy lines of breakage. We therefore break off the pieces, CCC, and by treating the remaining curved pieces, DDDD, as in the semicircle, A, we secure our shaped piece intact.

Thus in cutting pieces of any shaped section a little thought will enable the cutter to overcome all difficulties, by approaching the curves with intelligence, so that very soon, with the aid of diamond and pliers, he will be enabled to cut the most difficult pieces with very little breakage.

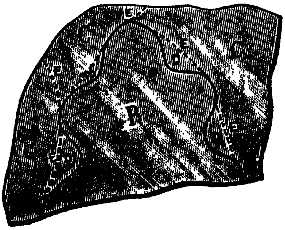


FIG. 10.

Piece by piece, little and big, straight and curved, the whole of the architectural work must thus be cut and laid aside in a shallow wooden tray, ready for the painter.

In cutting figure work it is usual to cut all the "white" glass first, and to commence with the "flesh"—the head, hands, feet, etc. After the flesh comes the white drapery. The flesh should be cut from a pale greenish-white tinted glass, free from all blemish of spots, "seeds" or scratches, as the light striking on these would give them the appearance of scars and be unsightly; whereas in drapery they would not be noticed—indeed, they would be necessary to give brilliance to the glass, as they arrest the rays of light, and by refraction give a sparkling appearance to the window.

Draperies may vary very much in tint, and should always be deeper than the "flesh".

As a rule, if the surrounding colour, or that in juxtaposition with the white drapery, is warm—that is, of red purple, yellow, ruby, or warm green—then the white employed may be of a somewhat cold green in tint; but if the surrounding colours are of blue or blue green or blue purple, it should be on the warm side.

There is, however, no set rule for this, different artists having widely opposed views upon the matter, some (the writer among them) never using a cold white except where circumstances imperatively demand it.

The white of the figure being cut, the coloured drapery is next taken in hand.

In the ruby under dress great care must be exercised in getting the pale part of the sheet of glass to come where the light would naturally fall upon the figure. To do this the various sheets of ruby must be looked over, and part of a sheet selected which is varied in colour to suit the exact light and shade required. This process of selection entails cutting out the choice parts of sheets, but if we are to study the ultimate beauty of the window, we must not grudge a little extra expense in getting just the right piece for the right place, even if it has to be cut from the middle of a sheet. We must save the larger of our odd pieces and work them in for backgrounds, if suitable for that purpose; if not, they must go into the cullet-box, as the receptacle for waste glass is called.

Blues, greens, purples, etc., for draperies must be selected with the same care, but as there is not so much variety in the individual sheets as in the ruby, the waste is not so great.

When the glass is so deep in colour that the eye cannot penetrate to the cutline below, recourse must be had to the pounce bag.

Hold up the sheet of glass to be cut to the light, and having noted the most suitably shaded part, breathe upon it, at the same time dabbing its surface all over with the pounce; this will give it a white coating; then place it as near as possible, *under* the cutline, at the part which has to be cut.

Next, with a bone or ivory "marker," trace over the outline of the glass to be cut with a firm pressure, and on removing the sheet of glass from beneath the paper you will find a black line ready for you to cut to, caused by the whiting being removed from the glass by the pressure of the stylus, which has made it to adhere to the paper.

Another way to transfer the cutline to the glass when it is too dark to see through is to place a piece of red transfer paper between the cutline and the glass, when by tracing over the outline with a stylus or marker a clear red line will be the result.

Probably a white transfer paper might be used for dark glass by preparing suitable paper with finely powdered whiting and poppy oil, with a suspicion of pork lard mixed with it.

As a general rule, keep to the warm side in colouring. By warm side it must not be supposed the term means employ all the ruby, yellow and red-purple glass you can, because that would simply result in a hot, glaring, vulgar window.

By warm we mean if in cutting you have to select, say, a green for foliage on a tree, let that green incline to yellow rather than blue; let the whites of drapery incline to sunny tints rather than a cold, icy one, and so through all the various colours of the window. Even blue, although a naturally cold colour, may by having a suspicion of green or purple in it be said to be to a certain extent warm; and thus if we are careful to keep our colours warm, without employing any really hot or vivid colour, we shall impart a peculiar glow to our work which no amount of painting and staining can achieve.

Whilst on the subject of cutting, we will say a little upon square, quarry and geometrical glazing which is done with the aid of mechanical means, foliated and other panels being in the main cut by freehand cutting, just as is the figure work.

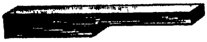


FIG. 11.—Cutting Gauge.

We will take the very simple cutting of squares first. Suppose we wish to make a "leaded" light—as all glass panels are called—of squares, we should first make a cut-line, and from it we should see that our squares are to be three and a half inches each way. First we take a flat piece of wood, six or seven inches long, and in its edge cut out a little strip three and a half (plus one-sixteenth) inches long.

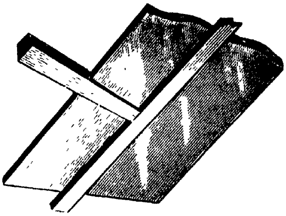


FIG. 12.—Cutting a Range

The sixteenth of an inch is equal to the space between the centre of the diamond and the edge of the cutting-lath—that is, when we use our "cutting gauge," as the stick is called, the diamond will cut off a strip of glass precisely one-sixteenth of an inch less than the length of the gauge.

Lay a sheet of glass upon the board, and placing a lath upon it, cut off a strip about half an inch wide so as to make the edge of the glass even. Then laying your lath three or four inches from the edge of the glass, proceed to adjust it by placing the shoulder of the gauge against the edge of the glass and the end against the lath. When you have adjusted the lath to an equi-distance from the edge of the glass all the way down, cut it and break off the strip, which is called a "range". Continue this process until you have your sheet cut up into ranges, then take them one by one, and with the aid of a small set-square and the gauge cut off your squares. This is a simple, but very accurate, method.

To cut quarries, first cut your glass into "ranges" as for the squares, then proceed to "set a quarry board". Take a piece of board an inch thick, from twenty-four to thirty inches

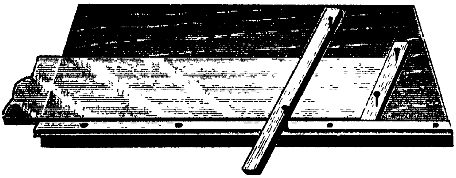


FIG. 13.—Quarry Board.

long, and, say, ten inches broad, along the edge of which nail a lath an inch wide, an eighth of an inch thick and of the length of the board—that is, your quarry board.

Now, take a range of glass and lay it diagonally on your cutline—full length—and accurately cut off one end to the exact angle of a quarry. Having that, lay the range of glass on the board and nail a short piece of lath to the angle of the quarry; then with the aid of the gauge mark off a single quarry on the range and place it again on the quarry board, as shown in Fig. 13. Now, by driving in tall nails where required, you have rests against which to place a thin cutting-lath, and you can then cut off one or two trial quarries, and placing them together turn them about to ascertain if they are exactly the same size. If not, you must alter the position of the tall nails until they are exact to a hair-breadth, otherwise your leading will be thrown out and the lead lines will not run true.

By the use of a quarry board any straight-sided shape of glass may be cut, and it is by its aid that geometrical patterns are cut so accurately.

Fig. 14 shows a number of geometrical shapes which may be cut by altering the positions of the nails on the quarry board, but shapes which are a combination of straight lines and curves are usually cut with the aid of thin cardboard patterns. Such patterns as shown in Fig. 15 are some of the legion used in geometrical glazing. Take a lead pencil and carefully draw the shape of pattern required upon a thin piece of cardboard, and laying it on a piece of smooth glass cut out the pattern with a sharp penknife. To cut the glass lay the pattern upon it, and breathing upon it dab it over with the pounce bag. Raise the pattern, and you have the required shape of clear glass outlined in whiting. Some cut the cardboard a sixteenth of an inch less than the size of the glass required. Then by laying the pattern on the glass and going carefully round it with the diamond the exact size and shape of glass desired is obtained.

When a great number of pieces of glass of the same shape are required, it will be as well to cut the patterns from the thin zinc, which may readily be cut with an old pair of scissors.

Yet other forms of glass may be cut with the aid of the quarry board and "circle board". The circle board is a useful but expensive mechanical contrivance for cutting curved work. It consists of a circular, leather-covered table, from twelve to eighteen inches in diameter, freely revolving upon a central pivot fixed underneath; over the table a brass arm extends, ending in an angle piece turned

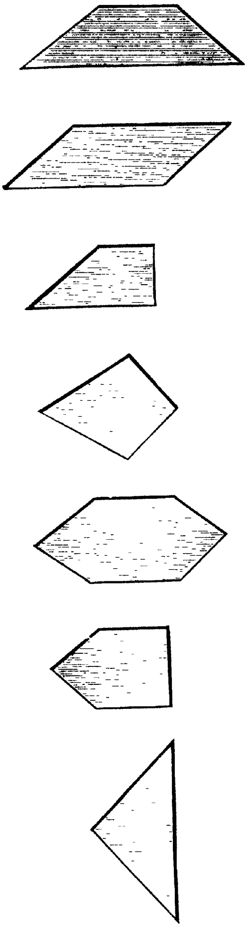


FIG. 14.

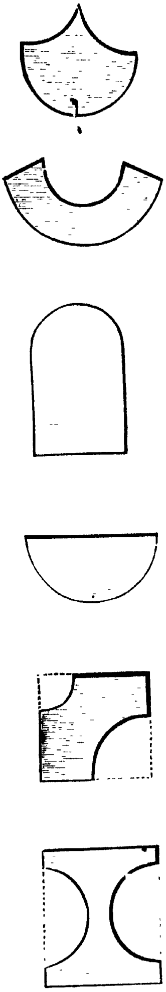


FIG. 15.

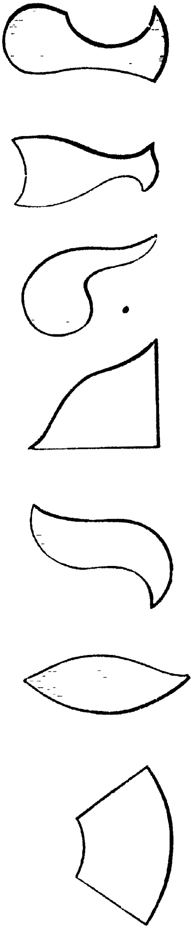


FIG. 16.

Glass Cut to Various Patterns

downward at the extremity, on which a cutting diamond is fixed. The arm is so arranged with screws and slides that by placing the glass on the table and rotating the latter, circles may be cut from it of any radius from an inch to seven or eight inches. A glance at the shapes in Fig. 16 will show how this may be easily accomplished.

In cutting, the intelligent glazier calls to his aid many little mechanical aids, and many little ideas will present themselves to a man of intelligence, which, although trivial in themselves, greatly add both to the accuracy and rapidity of the cutting, and give more accurate and neater glazing results.

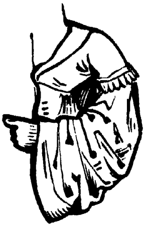


FIG. 17.—Fifteenth Century Hanging Sleeve.

CHAPTER V.

THE COLOURS AND BRUSHES USED IN GLASS PAINTING.

THE colours used in mosaic glass painting are very few, being principally shading tints—a little enamel colour and silver-stain; but upon their quality and firing powers the permanence of a modern window entirely depends.

We do not propose entering into the composition and manufacture of the colours, as they may be bought ready to hand, and are not made by even the largest firms of glass painters. It is quite unnecessary to go into the actual composition of the colours, as our concern is more as to what they will do than as to what they are made from. We may note that they are made of certain metallic oxides ground with a certain proportion of borax flux, which is literally a kind of soft glass, possessing the property of causing the metallic oxide to adhere and incorporate itself with the glass upon which it is painted. Without flux the colour would not adhere to the glass at all after firing, but must be incorporated with the oxide as a medium between the metal and the glass.

When the correct amount of flux has been ground with the colour, the latter appears smooth and glossy when fired, but if insufficient has been used the colour comes from the kiln harsh and dull, and not being thoroughly incorporated with the glass can be scratched off with a knife or sharp piece of glass. Such colour will inevitably peel and chip in the course of a few years, leaving the window in a deplorable state. Buy your colour of a reliable maker, and you will have very little difficulty with it.

It used to be necessary to have a small box or bottle handy containing borax flux, a little of which was ground with the colour upon the palette, when it was found that the colour did not "go down" (or become glossy) in the firing; but such is now seldom requisite unless some very poor colour indeed is used.

The chief colour used by the glass painter is known as tracing brown, and is more largely used than any colour in the list. It is used for outlining the various patterns upon the glass before it comes to the painting or shading stage. It is of a rich red brown, and has a glaring appearance if used pure; it is therefore usually mixed with one-fourth of tracing black, which gives it a vandyke brown tone.

If the pure tracing brown is used in outlining it will be seen, by reason of its vividness, upon the surface of the glass, and in looking at a stained glass window we want to look *through* not *upon* the glass, as we should if it were an oil painting. Some knowing the glaring quality of the brown tracing colour go to the other extreme and use only black tracing colour, but this is going to the opposite error; and when we know that by reason of its softer nature black is apt to "fire away" and become transparent, thereby giving a poor outline, we are constrained to come to the common-sense view that a mixture of brown and black produce a happy medium—solid, dull and permanent.

Solidity of outline is a desideratum, for if the outline is transparent and washy, the object depicted on the glass will not be clearly defined, but will present a blurred, undefined and unsatisfactory appearance.

The writer personally uses a uniform mixture of one part black to two parts brown, but the amateur may vary the proportions to suit his individual taste.

Umber is a warm brown, somewhat fugitive, and not adapted to solid lines. It is used for painting in oil, and to imitate the shade of ancient colour in shading. By saying "painting in oil" it must always be understood that the oil used by glass painters is "tar-oil," the medium for painting in after the preliminary operations of outlining, matting, etc., have been finished.

Umber loses much of its depth in firing, so that one must paint the work very much deeper than it is wished to appear after firing. To prevent this "firing away," a little brown and black tracing colour may be added to it, but they must be well ground first, and afterwards again well ground when the colours are mixed.

Copper Black is an intense black of a soft nature, and is apt to fire away or become very transparent in the kiln.

If tracing brown is found to be a little harsh and rough on the surface when fired, a little copper black will greatly improve it, and may be added instead of the tracing black.

Shading Brown and **Shading Black** are used for the purpose denoted by their name, and are really the same as tracing brown and black, but of a slightly softer nature, having more flux used in their composition.

In many firms both outlining and shading are done entirely with the tracing colours.

China or **Flesh Red** is principally used as a "backing" or toning tint for flesh painting. For this purpose—if used at all—it must be applied very sparingly or the figures will look sunburnt—like a jolly farmer—an appearance not desirable in a saint, especially if of the female sex.

This pigment was not known to glass painters before about 1510-20, consequently it is never seen in fifteenth century work at all, and for this reason is seldom used by modern glass painters, who work in the style of the late fifteenth century or early sixteenth century era. Its use, according to some critics, was one of the first causes of decline in the art —it was a help to obtaining the picture or canvas style into which glass painting afterwards degenerated.

If therefore flesh red is used for toning flesh, it should be the merest film—just enough to "waken the dead" in the greenish corpse-like tone of the glass used for modern flesh. The flesh red is usually applied to the back of the glass.

Stain.—The golden glory of a window is one of the simplest and yet one of the most difficult to use. It is easy to apply to the glass, but requires great experience to know how thin or how heavily to apply to individual pieces of glass.

To make this more clear, let us take four strips of any kind of pale glass, and with the stain let us coat each of the four pieces, keeping the same strength of stain on each, and send them to the kiln to be fired.

When we receive them again we find one piece has a beautiful golden stain, the next a pale lemon, the third a deep, opaque film, and the last a deep orange stain.

From this we learn that by altering the strength of the stain on the first piece as we apply it, we can obtain any tint of stain we require, either pale or rich. The second piece, if we want rich stain, we must coat much more heavily. This glass will probably be found of a flesh tone, which is a hard glass, and wants more stain applied than the first piece, which was of a normal greenish-yellow tone, the painter's ideal tint for staining.

The third piece of glass was of a deep greenish-blue white, and is unsuitable for staining; the component parts of the glass are antagonistic to the stain, and we therefore reject that glass altogether, or else greatly reduce the strength of our stain by adding well-ground yellow lake.

The fourth proves itself to be good staining glass—too good, in fact—as it takes the stain too kindly. We therefore either apply the stain very much more thinned out with turpentine, or, what is better, add an equal bulk of ground yellow lake to the stain, which will then come from the kiln a beautiful golden tint instead of the fiery orange.

As so much has been said and written upon it from its invention at the beginning of the fourteenth century, our readers may like to make some for themselves. If so, here is the recipe—one which thirty years' practice has found to be equal to or better than any other :—

Obtain one ounce of virgin silver, in as small pieces as possible for quickness of melting, and place in a gallipot or glass jar. Warm the jar thoroughly, and in it, upon the silver, pour an ounce of nitric acid, to which add two ounces of boiling water.

Place it in the open air on a sill, or on the stove hob, as it gives forth a yellow vapour of a pungent and unpleasant kind.

If in a glass pickle jar, you will see the acid furiously attacking the silver, melting or decomposing it, and boiling and bubbling round it in a terrible rage.

By-and-bye the bubbling anger ceases and naught apparently remains in the jar but a beautiful, clear, emerald coloured liquid. But our silver is there, nevertheless, held in solution. Fill the jar nearly full of hot water, and pour in common table-salt till it will hold no more. Next pour the whole into a larger vessel and fill with cold water, stir well and allow to settle. When settled, a thick white pulp will remain at the bottom—this is the nitrate of silver. Carefully pour off the water, so as not to lose a particle of the sediment, and fill the vessel again with water and stir it well up. Repeat this a dozen times during the day to eliminate the salt and acid. In the meantime grind—in water—three ounces of yellow lake ; grind it to an impalpable pulp—the finer the grinding the more successful the stain will be. Next day add the silver nitrate—which should have been allowed to drain as dry as possible—and grind them well and intimately together. When ground spread out on a glass slab and dry before a fire or in the sun. The stain is then ready for use.

Being in the form of a yellow powder, it is best kept in a wide-necked bottle.

For enamel painting on white glass a different set of colours is required. Enamel painting consists of firing several colours on one section of glass, quite different to mosaic stained glass, in which the glass employed is self-coloured or "pot metal".

Now and again the modern glass painter is called upon to use a little enamel for some little jewel, or enrichment of a border, a ring, or a crown. He has, therefore, by him tiny phials of blue, pink and, perhaps, green, though the latter can be made by applying the blue enamel to the front of the glass and staining the back; only he is not in this case so certain of the effect after firing as if he used the enamel green.

The mediums used in glass painting are sugar and gum for water-colour painting, and turpentine and tar-oil for oil painting.

If it is desired to simply outline a pattern on glass—such as in quarry work, and to stain the back—it is usual to mix sugar with the tracing colour so as to make it work smoothly, but if the outlining has to be painted over in water colour then the medium used is gum.

"Oil" colour is ordinary tracing or shading colour ground in turpentine and mixed with tar-oil to make it flow properly.

"Fat oil" is used as a medium for ordinary painting or shading colour, and for the stain.

"Fat oil" is simply turpentine placed in an open vessel

The fourth proves itself to be good staining glass—too good, in fact—as it takes the stain too kindly. We therefore either apply the stain very much more thinned out with turpentine, or, what is better, add an equal bulk of ground yellow lake to the stain, which will then come from the kiln a beautiful golden tint instead of the fiery orange.

As so much has been said and written upon it from its invention at the beginning of the fourteenth century, our readers may like to make some for themselves. If so, here is the recipe—one which thirty years' practice has found to be equal to or better than any other:—

Obtain one ounce of virgin silver, in as small pieces as possible for quickness of melting, and place in a gallipot or glass jar. Warm the jar thoroughly, and in it, upon the silver, pour an ounce of nitric acid, to which add two ounces of boiling water.

Place it in the open air on a sill, or on the stove hob, as it gives forth a yellow vapour of a pungent and unpleasant kind.

If in a glass pickle jar, you will see the acid furiously attacking the silver, melting or decomposing it, and boiling and bubbling round it in a terrible rage.

By-and-bye the bubbling anger ceases and naught apparently remains in the jar but a beautiful, clear, emerald coloured liquid. But our silver is there, nevertheless, held in solution. Fill the jar nearly full of hot water, and pour in common table-salt till it will hold no more. Next pour the whole into a larger vessel and fill with cold water, stir well and allow to settle. When settled, a thick white pulp will remain at the bottom—this is the nitrate of silver. Carefully pour off the water, so as not to lose a particle of the sediment, and fill the vessel again with water and stir it well up. Repeat this a dozen times during the day to eliminate the salt and acid. In the meantime grind—in water—three ounces of yellow lake; grind it to an impalpable

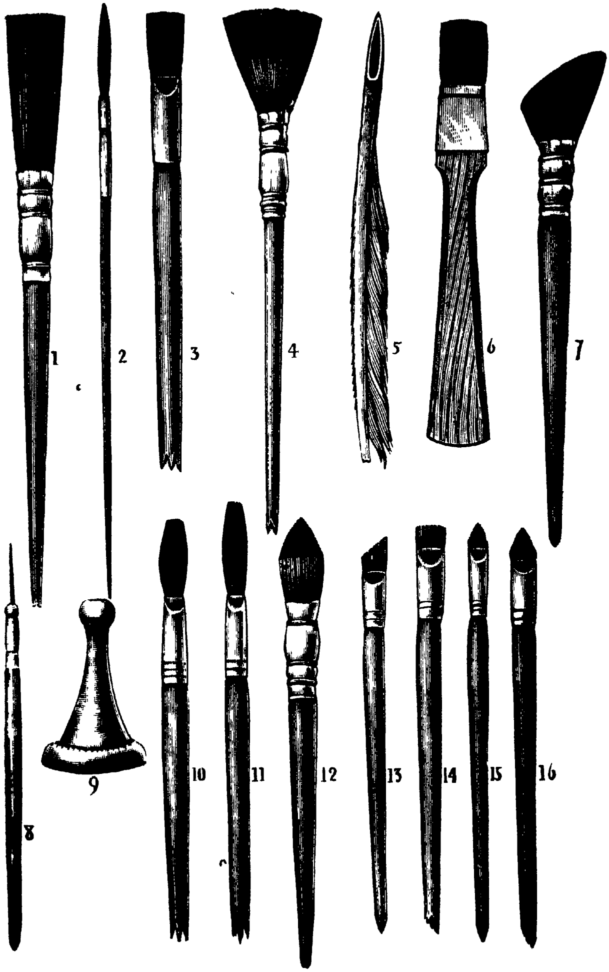


FIG. 18.—Glass Painting Brushes, etc.

1. Hog-hair Stippler.
2. Tracer.
3. Hog-hair Fitch.
4. Badger-hair Shader.
5. Quill Etcher.
6. Camel-hair Flat.
7. Skew Stippler.
8. Needle-point Etcher.
9. Glass Muller.
10. Camel-hair Painter.
11. Sable-hair ,,
12. Round Scrub.
13. Skew ,,
14. Square ,,
15. Pointed Round Scrub.
16. Pointed Flat ,,

The fourth proves itself to be good staining glass—too good, in fact—as it takes the stain too kindly. We therefore either apply the stain very much more thinned out with turpentine, or, what is better, add an equal bulk of ground yellow lake to the stain, which will then come from the kiln a beautiful golden tint instead of the fiery orange.

As so much has been said and written upon it from its invention at the beginning of the fourteenth century, our readers may like to make some for themselves. If so, here is the recipe—one which thirty years' practice has found to be equal to or better than any other :—

Obtain one ounce of virgin silver, in as small pieces as possible for quickness of melting, and place in a gallipot or glass jar. Warm the jar thoroughly, and in it, upon the silver, pour an ounce of nitric acid, to which add two ounces of boiling water.

Place it in the open air on a sill, or on the stove hob, as it gives forth a yellow vapour of a pungent and unpleasant kind.

If in a glass pickle jar, you will see the acid furiously attacking the silver, melting or decomposing it, and boiling and bubbling round it in a terrible rage.

By-and-bye the bubbling anger ceases and naught apparently remains in the jar but a beautiful, clear, emerald coloured liquid. But our silver is there, nevertheless, held in solution. Fill the jar nearly full of hot water, and pour in common table-salt till it will hold no more. Next pour the whole into a larger vessel and fill with cold water, stir well and allow to settle. When settled, a thick white pulp will remain at the bottom—this is the nitrate of silver. Carefully pour off the water, so as not to lose a particle of the sediment, and fill the vessel again with water and stir it well up. Repeat this a dozen times during the day to eliminate the salt and acid. In the meantime grind—in water—three ounces of yellow lake ; grind it to an impalpable different sizes) will be required, and care should be taken, in selecting them, that no coarse hairs have been accidentally mixed in the making with the soft ones. These are about all the painter requires in the way of brushes, but there are several other accessories to mention. Three glass mullers of various sizes will be wanted, *viz.*, an inch and a half, a two-inch, and a two and a half-inch one.

A needle point mounted on the end of a piece of hard wood is an admirable etching tool for flesh, heraldic charges, and wherever very fine hatched lines on a dark ground are required.

One of the simplest and most effective tools is a common goose-quill, cut like a pen, but without the slit for writing, for etching out the high lights in the hair or beard of a figure, for small diapered patterns, and a great variety of uses. The goose has aptly been called the glass painter's friend, not because birds of a feather flock together, but because in an able painter's hand the grey goose-quill can be made to do wonderful things, and to obtain peculiar effects upon matted grounds. Formerly the grey goose was the patron of archers, then of schoolmasters, and now of glass painters.

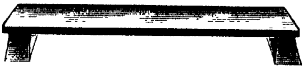


FIG. 19.—Hand Rest.

To make the quill-etcher, sharpen the quill as for a pen, but do not make the slit in it. Have some quills broad-nosed, others more pointed.

The hand rest is another useful tool, giving freedom to the tracer's hand when outlining, raising the hand from the work, and so keeping the sleeve and wrist from spoiling the wet work beneath. It is simply a piece of oak or mahogany, from twelve to twenty-four inches long, two inches wide, and three-eighths of an inch thick, mounted on two little wooden legs or ends about an inch and a half high. Beginners find this somewhat difficult to use at first, but in time it becomes indispensable, and no work should be attempted without it.

For taking out sharp lights some pointed pieces of lancewood will be found useful, as they will not break at their points, because of their toughness.

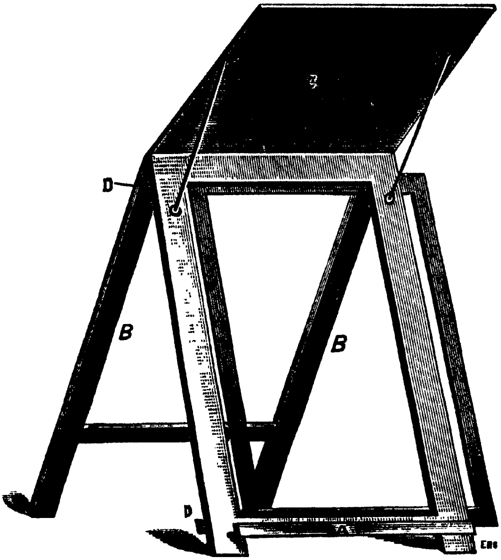


FIG. 20.—Improved Glass Painting Easel.

The last and most expensive requirement is an easel. This is of somewhat peculiar construction, but not at all difficult to make.

The front of the easel is a rectangle about three feet high by two feet broad, the side pieces being prolonged about three inches to form short legs. The wood of the front is three inches by an inch; upon the back at D, D are screwed two

L-shaped runners to hold a thin sliding frame, called the "paper-frame," being covered, when in use, with white tissue paper to subdue and diffuse the light. This frame is made so as to slip easily in and out between the runners, D, D. Long back legs, B, with a strut near the bottom, and a top piece above, are hinged to the front of the easel by a couple of ordinary butt hinges. An L-shaped ledge, A, is next screwed along the front of the easel, and the whole is complete.

The use of the ledge, A, is to support a thick sheet of glass, three feet by two feet, called the easel glass, upon which is fastened, with a preparation of beeswax and resin, all the little pieces of glass which go to make up a figure or canopy, and to hold them in their correct places while they are being painted.

Sometimes the easel has an additional wooden frame, C, about two feet square, hinged to the upper part of the front, and covered with brown paper. This being held in position by two side rods, keeps the glare of light which streams over the top of the easel from the painter's eyes. It is, however, hardly necessary, though it is used by a few fastidious painters.

By the way, a few ground glass palettes, a quarter of an inch thick and seven to ten inches square, will be required for grinding the colour upon, and that is all.

Now having our tools, brushes and easel, we will proceed to consider the art of the painter.

FIG. 21.—Mediæval Headdress

CHAPTER VI.

PAINTING ON GLASS—DISPERSED PATTERNS.

ACID WORK.

BROADLY speaking, there are two modes of painting. These are generally known as "painting in oil" and "painting in water," and are very different in technique. By the use of the first mode a delicacy and softness of modelling is obtained which, for work going near the eye, has charms of its own, while the water method gives fine broad results—crisp, sharp lights, is cleanly to work, gives greater depth and contrast of light and shade, and by its means we can, perhaps, come nearer the idealistic work of the early sixteenth century than by the other method.

Perhaps the better way will be to describe the painting of a figure in each style. The reader can then form an opinion of the methods, and select the one he fancies he can most readily manage, and in which he is most likely to obtain the best results.

As we have the figure of St. Paul drawn, and the glass already cut, it will be as well to take that as our example.

Our first method shall be that known as painting in oil. Grind up a batch of tracing colour, two parts of brown to one of black, and when very finely triturated, add sufficient brown sugar to make the colour flow freely from the tracing brush.

Of course the sugar must be ground up and well incorporated with the colour, and a few trials on a piece of glass will prove if enough sugar has been added.

The tests are that the colour should just flow freely from the pencil without dragging, should dry equally all over—not leaving wet spots long after the rest is dry; and when dry it should be fairly glossy, without being absolutely shiny like varnish.

If too much sugar is used the paint will not dry, whilst when it is being fired the particles of sugar will boil and cause the paint to rise in a number of minute bubbles and blisters, which give a peculiarly spotted appearance to the lines, called "frizzling". Too much sugar must therefore be avoided.

Some use treacle, some loaf sugar, and others brown Demerara sugar. The latter is the best.

Having ascertained that your paint is in good working order, lay your cartoon on your work board and proceed to carefully outline the head and hands.

Do the latter first, as being less important, and so get your tracer, paint and hand in working trim before attempting the head. See that the filling in round the outlines of the hands is solid and black.

Take great care in outlining the head, putting in good bold sweeping strokes for the hair and beard, and more delicate lines for the eyes, mouth, nose, etc., remembering that the centre line of the mouth, the under part of the nostrils, and the under part of the upper eyelids, will bear firmer and broader lines than in other parts. The lower eyelids and lower lip must be represented by mere hair lines.

The "flesh" having been carefully outlined, should be sent to the kiln for "tacking," as a light firing is called.

In the meantime we proceed with the rest of the figure. Laying the cartoon full length on the work board, the easel glass must be laid over it; and upon it, in half-tint lines, the whole figure must be traced, every fold and line being lightly touched in.

That being accomplished, wipe every piece of glass composing the figure very clean, and slipping the cartoon of St. Paul from under the easel glass, substitute the cutline, and carefully lay every component piece of the figure upon the easel glass in its exact position shown on the cutline. Next comes the operation of "sticking-up," that is, of fastening all the individual pieces of the figure upon the easel glass, so that when the latter is raised to a vertical position the whole of the figure will appear as if in one piece ready for painting, or as if it were a canvas with the flat colours blocked in.

Take a very small tin saucepan and into it break a quarter of a pound of pure beeswax and an ounce of resin, which melt and stir intimately together over a fire ; when thoroughly incorporated take a narrow strip of glass running to a blunt point, and, dipping it into the molten "wax," as it is called, proceed to fasten all the little portions of the figure to the easel glass by allowing drops of the wax to fall at the junctions and around the edges of the various pieces. When this has been carefully done, the easel glass can be gently raised and placed upon the easel, which stands on our work board, with its front legs near the front edge of the board, and its back to the window of the room, from which the light streams through the figure and gives it a very peculiar appearance, as it neither possesses folds nor distinction of any kind, except that it is what an artist would call "blocked out in colour".

But although there are no folds actually on the glass of the figure, yet we must remember there are folds indicated on the easel glass behind the figure — faint where there is white glass, and heavier where there is coloured glass.

This indication of folds, etc., is all we have to guide us in the painting.

We hang the cartoon in a convenient place on our left-hand side so as to be readily seen without turning the body, and then proceed to the painting of the figure.

Take another glass palette and grind up three parts brown tracing colour to one of black and add gum as a medium.

First with a tracer put in all the shadow lines of the drapery, the outline of the sword, pattern on the shoes, etc.

Next with a half-inch flat brush and the long-haired stippler go over the whole of the pieces of drapery, laying on the paint and stippling it with as much regard to light and shade as you can before the colour dries.

Naturally on the shoulders and the parts of the drapery upon which light falls you would stipple the colour sparingly, but under the hand holding the book, and down the right-hand side of the figure (looking at it), you would stipple in the shadow with more strength.

The next operation will be to take out with the various kinds of "scrubs" the light parts of the folds of the draperies. First with a pointed piece of wood, or a very small and pointed scrub, the highest lights of each fold of drapery may be roughly but accurately removed.

Then with scrubs of various sizes and shapes proceed to scrub out the lights from all the folds of drapery in a skilful manner, using little scrubs for small folds, and your largest for broad masses of light such as may be seen on the thigh, and on the lining drapery by the sword.

All this must be done in a very skilful and careful manner, gradating the lights into the shadows as much as possible, and leaving no harsh contrasts of light and shade in close juxtaposition.

Blend and soften, scrub and stipple out your folds of drapery wherever necessary, but remember that many folds do not require lights out at all—they merely want shadows put in; and this is another process.

When you have removed all the paint that your high light and half tones demand, you may strengthen up your drapery lines where required with a tracer, and also add the pattern to the borders of the outer garment. Trace in the grass, etc., put a pattern on the book and shoes, a few firm lines to the pommel of the sword, etc.

So far your principal difficulty will have been in the management of your gum colour. Let us put you right in this, as upon the correct working of the gum colour everything depends.

On a clean glass palette mix two parts of brown tracing colour to one part of black, and thoroughly grind it with water; then add about one twelfth of its bulk of gum, and regrind with a glass muller.

The difficulties of the beginner with his gum colour are many, yet when he has learned its proper mixing nothing can be simpler.

The difficulties are: –

1. The colour when dry upon the glass which is being painted comes off at the least touch, and will not stipple properly, will not lie flat, but shades itself in light and dark patches. This denotes too little gum; add more and try again.

2. The colour when dry will not come off under the influence of the scrubs, and where it has been traced on, or put on in a solid manner, it begins to chip and peel off. That means too much gum. Put half the colour aside, and grind a little more colour in water, and add to what is left. This will have the effect of reducing the strength of the gum and bring matters right.

3. After adding quite a lot of gum the colour will not act properly, for on trying to scrub out lights it comes off in patches leaving the glass quite clear, so that half tones are impossible. In this case the gum is impure, and for glass

painting purposes useless. Ordinary shop gum, or mucilage, has mixed with it a chemical for keeping it, or in some cases a spirit for the same purpose, and it is these admixtures which make the gum unsuitable for glass painting.

Make your own, therefore, and know what you are using. Take one ounce of pure gum arabic and place in a basin, and upon it pour a pint of cold water. Stir many times daily for several days until the gum is completely melted. Place a piece of muslin over a breakfast cup and strain the gum through, bottling it in a closely corked medicine bottle.

To test the colour before using is a simple matter, and should always be carefully done, as ten minutes' testing will give you hours of pleasant and certain working.

When you have ground your colour and mixed with it what you think a sufficiency of gum, take a little of the colour and stipple it upon any odd piece of glass—merely a patch of half tint—and let it dry. When dry take the tip of the finger, or, better still, the ball of the thumb, and rub the colour. If it comes off easily add more gum; if it is very difficult to remove, you have too much gum with it—add more colour. If it comes off gradually to the rubbing the colour is just right; try with a 'scrub, and if it comes off, leaving a nice gradation of tone, you may commence your work.

Under no circumstance commence your work until you are quite satisfied the colour is "right for gum," or disappointment and failure must follow, even with an experienced man.

Before this digression upon gum-colour we had brought our figure to a stage ready for oil painting, but before proceeding we place the head and hands, which have now been fired, in their correct places on the easel glass, and fix them. We now have the entire figure before us.

First strengthen, where necessary, any lines in the hair, beard, or features with a tracer, then quickly place colour over the whole head, and stipple it first with the long stippler, and, before it has time to dry, with one of the French stipplers, so as to secure as fine a grain as possible. Do this to the hands also. Again touch up or strengthen where necessary. Then most carefully take out the various "lights" from the face with round scrubs, off the forehead, cheeks, nose, etc., but see that these lights merge gradually into the half tint with which the face is covered ; no sudden lights must be removed, but everything done slowly and thoughtfully. Remove lights from the hair and beard with the quills, which with practice may be made to take out fine or broad lines, according to the pressure placed upon them and the angle at which they are held.

The beard of St. Paul gives fine scope for quill work, and the quill may also be used to take out bright lights in the borders of the cloak, pommel of sword, and wherever sharp lights are required.

Now we will take a third glass palette and grind our oil colour. Mix one part brown shading colour, one part shading black, and one part umber; grind thoroughly in turpentine.

Too much stress cannot be laid upon the admonition to "grind thoroughly". Its omission is the amateur's cause of non-success in many instances.

If there is any doubt as to whether the colour is sufficiently ground, dip a brush into it, and smear some of it upon a bit of window glass. If thoroughly ground the colour will be soft and smooth in texture, but if individual specks, atoms or microscopic grains can be detected, grind again and again till the colour is a mere impalpable mass, smooth and gritless.

Now look at our figure on the easel. It is a study in half tints and lights, with but little attempt at shadow so far, and it is with the oil colour that we now commence the painting purposes useless. Ordinary shop gum, or mucilage, has mixed with it a chemical for keeping it, or in some cases a spirit for the same purpose, and it is these admixtures which make the gum unsuitable for glass painting.

Make your own, therefore, and know what you are using. Take one ounce of pure gum arabic and place in a basin, and upon it pour a pint of cold water. Stir many times daily for several days until the gum is completely melted. Place a piece of muslin over a breakfast cup and strain the gum through, bottling it in a closely corked medicine bottle.

To test the colour before using is a simple matter, and should always be carefully done, as ten minutes' testing will give you hours of pleasant and certain working.

When you have ground your colour and mixed with it what you think a sufficiency of gum, take a little of the colour and stipple it upon any odd piece of glass—merely a patch of half tint—and let it dry. When dry take the tip of the finger, or, better still, the ball of the thumb, and rub the colour. If it comes off easily add more gum; if it is very difficult to remove, you have too much gum with it—add more colour. If it comes off gradually to the rubbing the colour is just right; try with a scrub, and if it comes off, leaving a nice gradation of tone, you may commence your work.

Under no circumstance commence your work until you are quite satisfied the colour is "right for gum," or disappointment and failure must follow, even with an experienced man.

Before this digression upon gum-colour we had brought our figure to a stage ready for oil painting, but before proceeding we place the head and hands, which have now been fired, in their correct places on the easel glass, and fix them. We now have the entire figure before us.

First strengthen, where necessary, any lines in the hair, oil, and the shadows systematically and carefully put in—not black shades, but so arranged that the light may easily penetrate even in the darkest parts.

The glass painter's art is not to blot out, and consequently lose, the glass, by reason of the depths of the shadows, but, without destroying his material, to modulate and shade the glass that folds and shades may be shown without absolute opacity. Too much shading and smothering the glass is a grave fault of many modern glass painters; the striving for pictorial effect such as one sees on canvas is too great, and the windows of these artists suffer in consequence.

Their work may be admirably manipulated, but is more fitting for canvas than glass; it is muddy and opaque, the brilliancy of the material is hidden and sacrificed, and the whole execution more suitable for a wall fresco than a glass window.

Revenons à nos moutons, or revert to our "flesh". Veins may be taken out of the left hand with a quill, and then softened down with the general shading of the hand.

The beard and hair may be painted over any colour the artist may desire—black, brown, or auburn—or may be left white; but the colour should not be stippled, only put on with a painter in a somewhat dry manner, so that the brush marks may show and the high lights beneath be seen.

This hair colouring should not be overdone for the first firing as an opportunity to strengthen will be given by-and-bye.

When all that can be done with the painter and stippler has been accomplished, high lights must be taken out sharply here and there with a wooden stylus or a quill. This must be done round the edges of the book, the clasp, etc.; the handle and one edge of the sword; here and there where light falls on the bordering, and round every piece of drapery which shows an edge.

The easel glass must now be taken down from the easel and laid flat on the work board, and the various pieces of glass detached, all those requiring to be stained being put aside, while those pieces which are finished are placed in trays ready for firing, only those to be stained being left on the board.

Some artists "back" all their white glass, a process which slightly subdues and qualifies its otherwise too brilliant appearance. "Backing" is simply the following: Each piece of white glass is slightly stippled on the back with water colour; when dry it is rubbed with the ball of the thumb, which gives the glass a varied and somewhat antiquated appearance. It certainly adds to the beauty of a window by giving it a certain air of old age, to which it is not perhaps legitimately entitled. The operation, however, is perfectly legitimate, and to be well done should not be overdone, otherwise the brilliancy of the glass is destroyed, and the whole thing looks more like a painting on paper than on a brilliant and cheerful material like glass.

The head and hands may receive a very slight backing of china red—just a suspicion.

The red should be ground in water and gum afterwards added—just sufficient to keep the colour from scratching or coming off too easily. It should be laid on with a camel-hair painter, and then smoothed off with a badger softener.

This is a very fugitive colour, and unless put on fairly strong will not show at all when fired. The flesh colour must not be put on so heavily as to produce a "healthy complexion," but merely so as to get rid of the unpleasant, corpse-like tint of the green glass.

As to the employment of flesh red at all, there is great diversity of opinion, many eminent painters regarding it with aversion, while others, especially of the Continental school, look upon it as a necessary adjunct. We have, indeed, plenty of examples of both German and Italian modern glass in which flesh red is not only used as a "backing," but as a surface colour of so deep a hue as to represent the "flesh" of a good, healthy, living individual.

This book is not written to discuss knotty controversial points, but merely to point out what is done in modern glass painting, and how to do it; we must be excused, therefore, from giving our personal opinion on many interesting matters. The last process prior to firing our figure is to stain certain portions.

Now for a few words as to stain. Stain should be well ground in turpentine—ordinary grinding will not do. Ordinary grinding means the amateur putting stain upon a glass tile, flooding it with turpentine, and splashing it about with a muller for two or three minutes. But if we are to be successful with our stain—and that often means the making or marring of a window—we must see that the stain is so finely ground that it forms a soft, creamy mass free from the slightest suspicion of grain or grit. The grinding process is tedious, and makes one's hand and arm ache, and it takes a long time to get to perfection; but that is a thing truly worth aiming at. When very finely ground, add just sufficient fat oil to make the stain flow freely from the brush. Its presence in sufficient quantity will also prevent the stain from being scratched, unless subjected to very rough usage. On staining different kinds of glass we will speak later. We have only to stain parts of the book, the nimbus, the sword-hilt, and the border of our present work, and it is ready for firing.

The stain should be applied with a flat camel-hair brush, and always on the back of the glass. Due regard must be given in staining as to whether a rich or pale stain is required, and the pigment coated on the glass in a thick or thin manner accordingly. Now our glass is sent to the kiln for firing; when it returns to us again it must be fixed on the easel with wax that we may judge of the effect. The flesh will look thin, and must be again attended to. For this a thin mat of colour should be either badgered over the whole surface, or else finely stippled with a French stippler. Perhaps very fine stipple is the better way. In passing, we may note that to "mat" glass is simply to cover it with gum or other colour, smoothed over with a badger softener, and is not now much resorted to by glass painters, as it does not permit light to pass through as in the case of stipple. When the stipple is dry on head and hands—and it must only be a very thin coating—proceed to model the face more by stippling out light where required, and after obtaining all the effect possible by that mode, again coat with tar-oil, and paint and round up the features with the oil colour. If carefully and deeply done, this second painting and third firing will be all that is necessary. The drapery must now be carefully scrutinised, and if any of it shows signs of being under-painted or too thin, it must be again gone over, either in oil colour, or if necessary both with water colour and then oil. A clever painter will finish his drapery at one painting; but as we cannot all be clever the figure may, in amateur hands, require almost repainting—in any case, much of it will. For the second painting avoid getting the shadows too heavy or dense, as, as a rule, the second coat of paint does not soften down so much in the kiln as the first.

Having thus looked over our figure, and retouched and repainted where necessary, we send it again to the kilnman for a light firing, and in his hands we will leave it while we consider how a figure may be best painted entirely by the use of water colour.

By water colour no other colour than brown-black gum colour is meant; a single drop of sugar or turpentine would ruin the entire batch of colour. Clean water should be used, so that there may be no risk of using water that may contain sugar.

We will paint a single figure as we did in the first case, calling our figure St. Peter this time instead of St. Paul. Lay the cartoon on the bench with the tray containing the various pieces of glass upon your left, and the glass palette, water glass, brushes, etc., on your right.

See that your colour is tested for gum, and, if anything, let the gum be rather slightly in excess than too sparingly used. First carefully outline the head and hands, and coat them on the flesh parts with china red applied in oil colour to the front of the glass, and let them be lightly fired.

In the meantime proceed to outline all the drapery, putting in all the folds, pattern of border, book, keys, etc., fully and solidly, remembering to put a solid line of colour round every piece of drapery where it acts as a boundary or defining line. This gives the glazier an opportunity of cutting or grozing a little of the glass from the edge of pieces requiring it, so as to make them fit their leaden environments closely.

When everything has been outlined, then, piece by piece, take each section of glass and, not too heavily, paint in the deeper shades of the various folds, not troubling to stipple them. This must be done with due regard to the toning off of the shadows, so as not to leave harsh dark lines where half tint only should be seen.

Only the principal shadows need be thus indicated, as the finer details will be best put in on the easel.

The next stage is to lay the cutline under the easel glass, and, as already described with the figure of St. Paul, fasten each individual piece of glass to the easel glass, including the flesh, which we will suppose to have been fired successfully.

Having the figure before us, we commence with a tracer to mend broken lines, make others run properly where two or more pieces meet, and generally to strengthen up our outline.

Black in outlining and filling in is the life of a church window; and, while avoiding absolute coarseness, it is difficult to put in the leading lines too heavily, while when it comes to ornamental patterns it will be seen that in many cases people do not look at what the artist puts on the glass for the pattern at all, but upon the glass which he leaves uncovered. The black outline and filling on the glass simply defines the pattern, which pattern is really the uncovered glass. The eye rejects the paint put on by the artist, and only collects the rays coming through the glass and forming the pattern.

Having strengthened our lines, we next carefully go over the shadows by quickly and delicately laying on colour with a camel-hair painter, which we immediately stipple down, having great regard for half tones and high lights.

The head and hands may have some of the deeper shades stippled in with the French stippler, leaving the high lights quite untouched.

St. Peter's hair and beard will be white: we therefore grind a small quantity of black shading colour and gum on a glass tile, and paint in the shadows of the hair and beard with it, using only a painting brush but no stippler.

Now comes a ticklish task, and one that will test our gum colour to the utmost, and that is, piece by piece, we have to put on a wash of paint with the half-inch flat, and stipple it without removing or in the least disturbing the under colour, folds, lines and shadows which we have so industriously been putting on.

Take only as much paint in the brush as you think will cover the piece of glass to be attacked, and do not let it be too wet or liquid; then lightly and quickly go over the piece of glass regardless of what is painted on it, and as quickly and lightly as possible stipple it all over.

Do this to every individual piece on the easel until the whole figure is coated a nice brown half-tint.

The larger the piece the more skill required, but time and practice will give the knack of covering such large surfaces without injuring the sub-colour as to a beginner would be quite impossible.

Of course a clever modulation of this over-coat of colour will do a great deal to help to round up the figure and give masses of shade. Where a knee or elbow bulges out drapery, or the light strikes on a shoulder, but little or no colour need be applied, for it will only have to be taken off again with scrubs, etc.

If you were careful with the drapery, you must be doubly so with the face, putting the colour on as thin, dry, and lightly as possible. You will be able to go dexterously over the whole surface with a fine French stippler without moving the under colour.

By these remarks it may be gathered how necessary it is to test and to have the gum colour exact before attempting to work with it; a little too much or too little gum and your work will be spoiled.

Little mishaps which occasionally occur must be patched and mended if not important, but if anything is radically wrong the piece must be entirely repainted.

Now commence with the head, and with quills, scrubs, and stippling scrubs set to work to etch out the lights from the face, hair, and beard. Do not etch so industriously as to remove every particle from the high lights, but allow a film to remain almost everywhere.

If little spots are difficult to remove, etch them away with the needle point set in a handle.

The drapery must in turn, fold by fold, be lightened with scrubs and stippling scrubs in the same manner, taking care to graduate the colour between the high lights and the shadows, so as to give a softness and tone instead of dashing at once from light to shadow, as if the folds were steel armour instead of cloth or linen.

The head and hands should now be carefully removed from the easel glass and fired, after which they should be put in place again, and once more stippled over with a fine, thin film, from which lights are to be again taken. Then, very delicately and quickly, the deeper shadows must be stippled in.

The quill will again be requisitioned for the hair and beard, and where its track is too crisp and sudden a flat scrub must be used to go over the part, so as to leave streaks like individual hairs, which, if necessary, can be altered, toned down or obliterated by going over with the flat brush charged with black colour.

All the drapery, which is now in a condition of light and half-tone, must next have the shadows stippled in with gum colour, and the sharp "stick lights," as they are termed, removed from the edges of drapery, keys, book, etc., with a sharpened stick or quill.

Now, as in the figure of St. Paul, the individual pieces must be removed from the easel and placed on the work board. All the dark pieces may be put into a flat wooden tray, but the pale pieces should have a "backing" of gum colour stippled on, as in the first figure, and this should also be rubbed with the ball of the thumb. Stain should be put on the back where required, and the whole may then be sent to the kiln.

On its return the figure should at once be put on the easel glass, new pieces cut to take the place of breakages, and the whole scrutinised. If any pieces are thin in painting they should be again gone over, and any little improvements or details added.

Water-colour drapery does not often require a second painting as a whole, but still minor pieces may require a little attention.

It must not be imagined that these two methods are the only ones employed by modern painters, but they give the groundwork and fundamental principles from which a dozen styles and combinations spring, and almost every devotee of the art has a different way of getting his effects, putting in his details, method of taking out lights, proportions in mixing his colours, depth of painting, manner of staining, etc., which mark the individuality of the man, and give a definite character to his work.

Another method of figure painting is a combination of the oil and water processes: drapery is outlined and the deeper shadows put in with water colour, after which the folds are rounded up and the half tints are added in oil colour. This method has a very soft appearance, and has a number of followers.

Heads are often traced in sugar colour and fired; then matted or stippled over with gum colour and lights taken out; the shadows are then put in with oil colour, and the hair tinted with the same. The head is then fired a second time.

The next process is to model up the head in finely stippled oil colour, rounding it up and putting in all necessary touches, after which it receives a film of china red on the back, is stained if necessary, and again fired. This method of painting gives beautiful results, but care should be taken to finish at the third firing, for a fourth is very often fatal—the glass naturally becomes more brittle at each firing.

For a head to fly at the third firing is a disaster for which there is no remedy, save to recut and repaint it with the fervent hope that it may this time be satisfactory and no further breakage occur.

For "canopy" work—the generic name of all architectural ornament, whether canopies, shaftings or bases—there are two or three principal modes of painting, each of which we will briefly glance at.

In all cases the glass has to be thoroughly cleaned. The glass merchants, in marking the length and breadth of each sheet of glass, use a strip of soap or a candle to indicate the figures, and special care must be taken to see that these greasy marks are entirely removed from the glass, or the colour will not "take" in the parts where any of the grease remains. A bowl of water with a little common soda or lime in it will clean the glass very effectually. As the glass is wiped, lay each piece upon the cutline in its correct position.

When that is done the whole of the canopy, piece by piece, must be outlined on the individual pieces of glass in sugar colour, care being taken to put in plenty of solid black around the pinnacles, crockets, etc., and not to be afraid to make good, strong main lines, with plenty of black wherever you can put it, so as to accentuate pattern and outline. The black you put on the glass will not be seen when a person looks at the window, he will only perceive the pattern which your black lines enclose and form.

When everything is well outlined, little bits of shadow may be carefully put in with a camel-hair painter, but only just indicated. The glass must then be fired. Upon its being returned the easel glass must be placed over the cutline, the glass laid out in its exact place, and the whole fixed to the easel glass with the wax composition as previously explained.

On being placed upon the easel the outlines must be corrected, half tint lines made black, broken lines made good, weak spots filled in, etc., then the whole must be finely stippled over with a liberal coat of black-brown gum colour and allowed to dry.

The high lights must then be removed sharply and crisply with a painted stick or quill. Then with scrubs the ordinary lights must be taken out from all parts, both stem work and ornamental details.

When this is done the whole effect will be a very beautiful one of high lights, moderate broad lights and half tints. It now remains for the work to be finished with oil colour.

This is applied, just as it was in the case of St. Paul's drapery, by moistening each piece with tar-oil and then stippling in the shadows, using the colour as dry as possible to prevent running or blurring.

Where necessary a few more lights may be taken out with a stick, and the glass is ready to be removed from the easel. Before releasing the canopy from the easel glass it will be as well to allow the paint a couple of hours to dry, a process which may be facilitated by using one part of tar-oil to two parts of raw turpentine when stippling the oil-mat on the glass.

When the pieces are ready they should receive a thin stippled mat of gum colour on the back, which should be slightly rubbed with the ball of the thumb to give it a somewhat subdued and old appearance.

The stain should then be applied to the back; but it must not be forgotten that where stain has to be applied the "backing" colour must be first removed, otherwise the stain will have a muddy and opaque appearance. The glass is then fired, and if painted deeply enough will need nothing further done to it.

Amateurs unfortunately have a knack of painting their work so as to look well on the easel, but when it is fired they are astonished to find themselves confronted with the ghost of a canopy or base, or whatever they have been painting. They forget what a lot of the colour is eliminated and dispersed in the firing; or they are timid and fear their work will appear over-painted, opaque and dirty, consequently a failure. Such solidity never mars the amateur's work; his boldness and depth vanish in the kiln, and leave an insipid groundwork just ready to be painted and fired again—a clear loss of time, money and effect. But *experientia docet.*

Now we will inquire into another method of painting canopy work, this time all in water colour, and to be finished at one firing—a crisp, workmanlike mode. Clean the glass as before and outline with gum colour, not neglecting the former precaution of not having a bit of sugar colour near, and to use clean water for fear of the contamination of sugar, which utterly spoils gum colour.

Outline with plenty of black, give vigour and spikiness to all the little details of crockets, finials, terminals and enrichments in general.

That being accomplished, the work must be "stuck up" —that is, fixed with the little drops of wax on the easel glass, which is then duly placed upon the easel. Mend all lines, make broken curves correct, marry diverging lines, and see that everything is perfect.

Next, with a camel-hair painter and small stippler, put in all shadows, giving deeper shadows an extra touch. Everything being perfectly dry, you must take a half-inch flat and your large stippler and stipple over every separate piece of glass—just a nice, deep, half-toned, fine stipple.

When this is dry, with quill and pointed wooden stylus, take out the high lights from the glass, which is now so dark that the details of ornament can only be seen with difficulty. Now a word of caution: in putting on the stippled mat let no shadow be so dense but that the underlying ornament may be seen and defined beneath. If this rule is adhered to the work will not be too heavily painted when fired; but if the stippled mat is so heavily applied that the detail of ornament is obliterated, then you have set yourself a very hard task to find what you have hidden, and the probable result will be an over-painted, dull and dirty canopy. Therefore use caution in applying the stippled mat, which looks darker and more opaque after it is dry than during the process of stippling when it is wet.

After all the crisp, telling high lights have been etched out the scrubs must be brought into use, and the broader lights taken out in bold sweeps—not forgetting to leave some colour on the glass—just a tone—even in the highest lighted parts. A little tone left on the glass does not detract from its brilliancy, and keeps the wireguards from so painfully grinning through, as they do in some thinly painted windows.

If, after the lights are taken out, a little more shading is required in parts, it may easily be done by stippling colour over the part.

With care wash after wash of colour may be stippled over the same piece of glass until it becomes absolutely opaque, and yet the first layer not be harmed in the slightest degree.

The glass may now be knocked down from the easel glass and stained, and is quite ready for firing.

A third mode of canopy painting is this :—

Clean the glass; lay it out on the cutline, and, piece by piece, outline it in gum colour, to which an extra *soupçon* of gum has been added to give the lines firmness and be less liable to "wash up" in the after painting.

That being done, stick the work on the easel glass and look it over to see that all lines run, etc.

Next, commencing at the top, put in all the shadows with a camel-hair painter and gum colour. Let the gum colour be the same that you outlined with, but with just a modicum of fresh colour ground up and put with it, so that, while it may be easily removed with scrubs, there will be no danger of the outlines being scrubbed away at the same time.

Round up all the ornamental detail in a broad manner, not paying particular attention to finish; the thing is to get enough shading on and to lightly cover over the half tints so as to get a ground to work upon.

A batch of oil colour must now be ground in turpentine, and a little fat oil added, just sufficient to make the colour work properly. Keep the colour as dry as possible in the grinding. With a half-inch flat and a large stippler you must go over every piece of glass, stippling on colour as deeply as possible without losing the outline by putting it on too deeply.

Remember that when the turpentine evaporates the stippled colour will appear much darker than when it is being put on. For a "medium" to dip your brush in occasionally use turpentine in which a few drops of tar-oil have been mixed and stirred.

The canopy should now be left for an hour to dry. When quite dry take out smart, bright, stick lines for high lights, and also take out little bright spots for the highest lights on all ornamental detail, edges of lines, finials, crockets, etc.

Then, with scrubs of various shapes and sizes, principally the round stippling scrubs, take out the broader ordinary lights, getting nice gradations of tone from the brightest stick lights, through ordinary lights into semitones, and so gradually into the deepest shadows.

When the process is completed the whole should appear some degrees darker than it will be after it is fired. If it looks on the easel as you would wish it to look in the church you will be sadly disappointed with your work after it is fired, for it will then look weak and paltry.

In reason it is almost impossible to paint too deeply in this style, as so much of the colour, being oil colour, disappears in the firing.

Take the glass off the easel, stain on the back, and your work is ready for firing. It should receive what is termed a "light fire," and for this reason may be stained a little heavier than usual. The greater the heat glass is subjected to, the deeper the stain strikes and the richer it appears. A "light" or "slack" fire gives a somewhat weak stain unless the precaution is taken to put the stain on stronger than usual.

Inscriptive Labels.—These are for the purpose of naming the saint or subject depicted, for the display of a text, or to receive a memorial or dedicatory inscription.

There are two modes of writing these labels: one is to show a black letter on a white ground, and the other to show a white letter on a black ground.

For the former it will be necessary to rough out the inscription on a piece of paper, so as to show the height of the letters and to give correct spacing. Next mat or stipple the surface of the glass very lightly, then by laying the glass over the paper the writing may be traced upon it either in gum or sugar colour, and care should be taken to get the letters solid and black.

After the letters are corrected, made upright, etc., with a pointed stick, the back of the glass should be matted and stippled in gum colour to a pale half tone, and then rubbed over with the ball of the thumb. Stain on the back where desired as capitals, figures, stops, etc.

For white letters on a black ground the whole piece of glass must be solidly and opaquely coated in gum colour to which a little extra gum has been added, so as to make the paint less likely to become scratched.

The colour must be regulated on the surface with a few touches of the badger-hair softener, not with the stippler. When the colour is perfectly dry rule lines upon the surface the height of the letters with a white chalk pencil, being careful not to scratch the colour in so doing.

The lettering must then be spaced out with the chalk, and the letters patiently removed by etching with a pointed wooden stylus.

It will be well to note that when showing black letters on a white ground the letters should be thick and gouty, because the rays of light wrap round the black letters to a certain extent, and so appear to the eye to make them thinner than they really are.

On the other hand, white letters on a black ground should be kept thin and delicate, because the rays of light coming through the glass to the eye expand or diverge, and so at a short distance make the letters look broader than they really are.

Modern inscriptions are usually and rightly in very plain lettering, and can easily be read by ordinary persons, whereas old church text and "black letter" is frequently dubbed "Latin" at a glance, and the observer does not take the trouble to puzzle it out.

Texts in Latin are only for the upper classes, of whom a few may be able to give a fair translation, but the dead language, upon which our own language is so greatly built, is to the average visitor an unknown tongue, and probably not one visitor to a church in fifty can understand or translate them, or translate them even fairly.

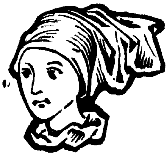


FIG. 22.—Flemish Headdress.

CHAPTER VII.

DIAPERED PATTERNS—ACIDING—FIRING.

DIAPERED patterns are placed both upon drapery and upon backgrounds. Some of the patterns are "traced on," and others are "picked out" from colour thickly matted upon the glass.

We will take the drapery diapers first.

Some diapers of the late fifteenth and early sixteenth centuries are very elaborate, and often composed of lines of pearls in beautiful reticulated sections, each of which has an elaborate medallion of foliated work as a centre-piece. These diapers covered the whole dress, and were called running diapers; others were sparsely strewn over the surface of the drapery with unornamented space between—these were known as "powdered" diapers, or "spot" patterns.

Drapery diapers are usually "traced" upon a garment, and are placed there to break up a large surface of colour, and to give elegance to what might otherwise be a somewhat glaring and bald mass of colour.

Little birds, animals, flowers and many quaint devices were often introduced into these patterns, which were nearly always black, except where the surface of the glass was abraded or eaten away with acid, so as to show the under glass beneath the coloured "flashed" glass.

Suppose we have a ruby dress, and wish to have a diapered pattern of yellow and white upon it. We must first acid away the flash of the ruby glass to whatever pattern we desire, and so expose the white or tinted under glass. Then we outline our pattern with tracing colour on the front, stain on the back the parts we wish to be golden, and leave the white part untouched.

The process of "aciding" we will notice in due course.

On white glass it is only necessary to outline the pattern and stain it upon the back, by which simple means some most beautiful patterns may be arranged; and a skilful painter will so work that his diaper consists of solid black lines and arabesques, interspersed with washes of half tint from which, with quills and sticks, he can etch out a wealth of embellishment of pearls and lacework filigree; and with his stain he can also get very fine effects, putting in some of the pattern of a quiet lemon tone, while other parts he can bring out of a fine rich yellow or orange bordering on ruby.

These diapered devices and intricate patterns are infinite in variety and beauty of colouring, and perhaps in the whole range of the glass painter's art there is nothing which gives a finer effect than a well-balanced diapered pattern.

After examining a few examples of ancient ornamental diaper work, any ordinary artist may sit down and make any number of these highly effective designs, keeping simply to black, half tone, light and dark stains, and, of course, the white of the glass itself.

Another very elegant way of putting a diaper on white drapery is to paint the garment in the ordinary way, except that the light and shade may be more pronounced—that is, the transition between light and shade may be more sudden and abrupt. Then take your drapery from the easel glass and put it on again, but reverse each piece of glass, so that the painted side is to the easel glass and the clear side towards you.

Now finely stipple a half tone all over the glass—not too dark—and from it, with quills and fine scrubs, take out a flowing diaper, bright and sharp, a pattern that well covers every part.

When the glass is fired and leaded the effect is that of a beautiful damask pattern, giving a soft, silky appearance to the whole garment.

Yet another mode of producing a fine effect is to reverse the glass upon the easel as described above, and to paint a diaper upon it in stain. Use a tracer for the main lines and a flat camel-hair brush for leaves, flowers or broader work.

By varying the stain the effect is peculiarly soft and bright after the glass is fired, as it comes out like richly embossed silk, a golden pattern on a beautiful silver ground.

With these several styles of diapering it will be seen what a wealth of beautiful design and enrichment is in the hands of the artist who is master of his profession. This class of ornament is practically unlimited in design, change and variety of colouring, depth or softness, and is a trump card in the hands of the glass painter.

Backgrounds of canopies, etc., are of several kinds, but that most in vogue is the "picked-out" diaper.

For this the glass should be thickly stippled with gum colour—in fact it may be so deep as to be almost opaque.

The pattern may then be indicated on the surface with a white chalk pencil—just the leading lines sketched—and the device, usually of a floriated pattern, "picked out" or etched out with pointed sticks and fine-pointed scrubs.

The fifteenth century diapers were, many of them, of an exceedingly elaborate nature, and many good examples are still extant.

When the pattern is picked out the glass should be roughly stippled on the back in half tone, and when dry rubbed with the ball of the thumb; this gives a fine effect, and greatly helps the light and shade effect of the glass.

Sometimes diapers are traced on backgrounds, but the effect is not nearly so good.

Curtains at the back of figures are usually treated with a black diaper, with here and there a little light taken out, but this must be done sparingly, as the object of a curtain is to serve as a background to a figure, and as such, however beautiful it may be in itself, must be kept back and quite subservient to the figure which it is intended to throw forward.

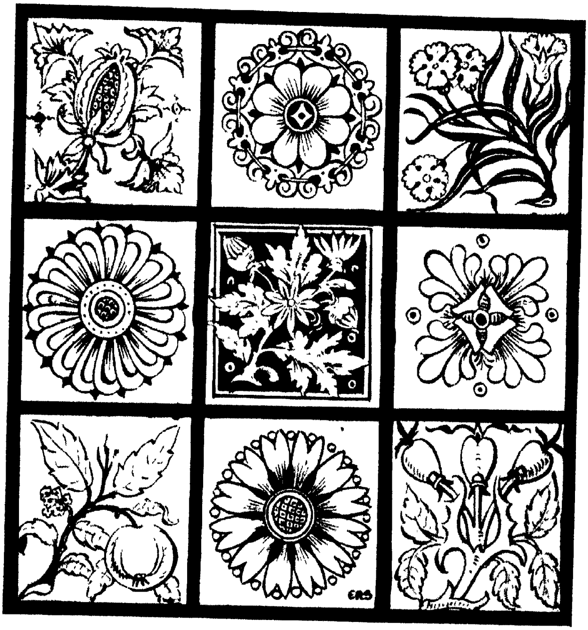


FIG. 23.—Patterns for Decorating Squares

Quite a book might be written on the beauties and merits of diaper patterns, but sufficient has been said to point out the principal modes of manipulation and to indicate the best kind for various purposes.

Borders and fringes might almost come under the same heading, as they are wrought in the same manner, and only introduced to embellish drapery, curtains, etc.

Usually where borders, etc., are shown the drapery itself is left plain, as a too bedizened figure cumbered with richness is like an over-dressed person, or like a man who tries to gild the lily.

There can be no greater mistake than to over-elaborate a window. By doing so the breadth of the work is destroyed, and the whole effect is not beautiful, but laboured and overdone—an *embarrasment de richesse*

Fine, well-balanced figures, richly coloured, and with a little relief of handsome diaper work here and there, is the ideal of a modern painter; but to know the point where to stop putting on the merely ornamental is learned only by experience and observation: it cannot be taught.

ACID WORK.

It frequently happens that it is desirable to remove the surface colour of certain pieces of glass, as when a pale diapered pattern is required on a ruby dress, or small devices upon an heraldic shield having a blue, red or green field; in such cases it is usual to resort to fluoric acid for the purpose.

Anciently patterns were removed from coloured glass by abrasion, a long and delicate task of chipping with suitable steel implements, or a small wheel with a rough surface, but the operation is now carried out in a much quicker, cleaner and neater manner.

The process of aciding out any desired pattern or shape is this: We take, say, a small heraldic shield cut out of ruby glass, upon which we wish to show the sacred monogram

I H S in yellow and white. To do this we draw the letters on paper, and, laying the ruby glass over it, outline the letters (taking care not to encroach upon the lines bounding the letters) with Brunswick black. That being done, we coat over the whole of the ruby ground with the same colour, leaving only the letters themselves untouched.

When thoroughly dry, hydrofluoric acid (made from fluor-spar and sulphuric acid) is applied to the letters with a soft brush, and allowed to eat off the hard ruby surface of the glass.

Care should be exercised in ascertaining that the "flashed" side of the glass is uppermost before applying the Brunswick black, or your entire labour will be in vain.

The acid used should be strong and give forth fumes when applied to the glass, and should be kept constantly in motion with the soft brush, so as to remove the scum of disintegrated glass as it forms.

After a time it will be noticed that the parts under treatment will become lighter, and any obstinate parts must be more plentifully covered with the acid. Lighter and lighter will the flashed surface become, until at length the whole of the lettering stands out white.

Wash off the acid, and, laying the shield flat, scrape off the Brunswick black; then wash away any remaining spots of the black with turpentine, and afterwards wash the shield in soda water and a little soap.

The latter process removes all suspicion of grease, and the glass is ready to paint upon. When staining the back of any flashed glass remember that such glass is very flinty, consequently a very liberal coating of stain must be applied. If it is found that the Brunswick black has a tendency to peel off, a little well-ground red lead may be added to it.

In heraldry it is usual to "lead in" the various charges where it is possible to do so without clumsiness, but when a number of small charges have to be shown in a circumscribed space leading is out of the question, and recourse must be had to the fluoric acid, which does its work so neatly and well.

The acid will also be found useful for a number of other purposes, as for lightening certain parts of drapery, and to help to emphasise the folds by eating away, in a broad manner, a little of the flashed colour, and so in a manner painting the figure by giving extra value to the light and shade of the glass itself.

Much effect may be obtained in this manner, but the operation must be skilfully performed and not overdone. Another use for the acid is to remove colour or paint from the surface of glass when a mistake has been made, and not noticed until the glass has been fired. In doing this the correct part should be coated over with soap, tallow candle or any kind of grease, so that the fumes of the fluoric acid may not affect the surrounding paint.

Yet another thing in which the acid is of use is to remove or soften a redundancy of stain. This must be done very carefully or the stain will be eaten away in white patches, and have a very unsightly appearance. If the stain is really very bad and blotchy, it will be found expedient to remove it entirely by means of the acid—and to restain it again.

It is hardly necessary to point out that this powerful acid must be carefully used as it will destroy one's clothes wherever it falls upon them, and unless quickly removed from the fingers will turn the skin yellow and destroy it.

There is no need, however, for the hands or clothing to come into contact with the acid, as it can be very conveniently manipulated with a long-handled brush, and aciding after all is only an occasional part of the painter's art.

The hydrofluoric acid may be bought of any wholesale chemist, and must be kept either in a gutta-percha or leaden bottle, tightly stoppered, and kept in a safe place out of the reach of children or servants.

FIRING GLASS.

The process of burning or firing the glass, as it is technically termed, is quite outside the province of the artist, and is a business entirely by itself, and as special premises and expensive kilns are required it is only in the large firms that we find them, and they are there worked by a special kilnman and his assistants.

Happily, however, there is every facility for both professional and amateur glass painters to have their glass fired by individuals who, having kilns of their own, make a business of firing for the trade.

The price charged for firing varies from 4d. to 6d. per superficial foot, the glass being fired at the owner's risk.

Breaks and accidents will occur, but in the hands of an experienced man the percentage of breakage is very small.

Formerly the kilns were fired by using coke under the box of the kiln, but the most approved method is now by using a great number of gas jets inside the kiln or oven.

The kiln is a large rectangular iron box, made in sizes varying from six feet by three feet to as small as a foot by ten inches.

In these kilns are iron trays sliding in grooves in the sides of the box or firing chamber, upon which is sifted a liberal coating of powdered whiting or sometimes gypsum. Upon this bed the glass to be fired is arranged, close to, but not touching, its neighbouring pieces, and the trays being placed in the kiln the iron door is closed and looted round with cement to prevent a draught from cracking the glass.

The gas jets are then lighted, casting out a tremendous heat, which causes the glass to become first red-hot and then to glow with a white heat. The skilled kilnman knows exactly the moment to withdraw the glass by constantly inspecting the interior of the oven through a little aperture arranged in the centre of the front of the kiln.

When the glass is sufficiently fired the gas is gradually turned down and finally out, and the glass either left to anneal or cool in the kiln, or else the trays of glass are quickly taken out and placed in another iron chamber, called an annealing chamber, and there left till nearly cold, when the glass may be safely removed and placed in wooden boxes.

The great thing to avoid is draught when the plates are removed from the kiln to the annealing chamber, for a gust or wind at the crucial moment would break every piece of glass on the iron plates.

Small kilns in the hands of amateurs are very liable to bring disaster to the glass, which usually comes out either overdone, underdone or broken. Glass sent to an experienced kilnman is put into a large and well-regulated kiln, and has every probability of coming home intact.

Those living in the country can always have their work fired by sending it to a properly accredited kilnman, and in such cases it will go safely through the post or on a long railway journey if carefully packed between layers of cotton wool in a wooden box.

FIG. 24.—German Headdress, 1490.

CHAPTER VIII.

FRET LEAD GLAZING.

THE art of fret lead glazing is not at all difficult to acquire. As in most other things, a fair proportion of common-sense and a little patience will go a long way to overcome any little difficulties that will occur.

The glass being cut ready for glazing, the first thing is to spread the cutline smoothly on the work board, and upon it lay out the entire "light" or window to be glazed—that is, every individual piece of the canopy, figure and base—and replace any missing pieces. It is exactly like a child piecing together the various sections of a puzzle picture, and care must be taken to see that every piece is in its correct place. Having laid out our work, we will see what tools we require—fortunately they are few, and, with one exception, inexpensive. That particular tool is the glazier's diamond which we spoke of under the head of "Cutting," and which we will assume is already purchased. The set square we also have, likewise the pliers, and we therefore only require a lathekin, a cutting knife, a stopping knife, soldering iron, and nails. The lathekin, the most ancient tool of the glazier, is simply a piece of hard wood—box, lance, or ebony—cut to the shape shown, for opening, pressing and regulating the leads. It should be an inch and a half wide, eight inches long, and a quarter inch thick. The cutting knife is made by snapping off a broad-bladed palette knife, so as to leave about five inches of it in the handle. A keen edge should be put on it, slightly skewed, so as to cut the lead easily. The stopping knife should be made from a broad-bladed oyster knife. When bought the blade will be perfectly flat, but it must be heated and bent to the curve shown in the illustration. It is useful for turning up leads to replace broken pieces, and many other things. The gas soldering iron, to be bought at the large glass merchants or leading builders' ironmongers, saves a great deal of time, but for those who

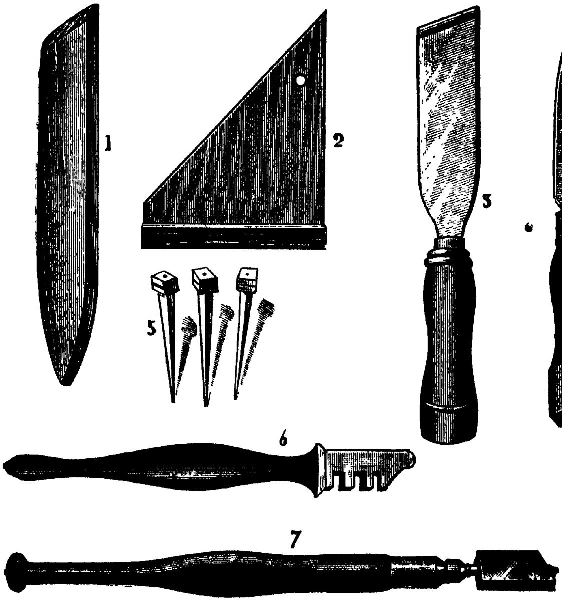


FIG. 25.—Glazier's Tools.

1. Lathekin.
2. Set Square.
3. Cutting Knife.
4. Stopping Knife.
5. Glazing Nails.
6. Wheel Cutter.
7. Glazier's Diamond.

reside in the country, where gas is an unknown luxury, the old-fashioned copper bits are the only available implements with which the joints can be soldered. The nails used by glaziers are the peculiar hand-made "lasting tacks" used by bootmakers. They cost about twopence per dozen, and four to six dozen will be required. They have square heads, and are an inch and a half in length. A hammer completes the glazier's kit, except for one or two trifles we will mention as we proceed.

The lead used for glazing purposes is first cast in an iron mould, into strips about eighteen inches long, which are afterwards subjected to great pressure in passing through a mill or vice having regulating wheels and cheeks of hardened steel. Through the mill each "casting" is squeezed, until it finally appears in the form of a "calme," or strip about five feet long. It can be turned through the mill in a variety of patterns and sizes, the latter varying from an eighth of an inch to half an inch in width.

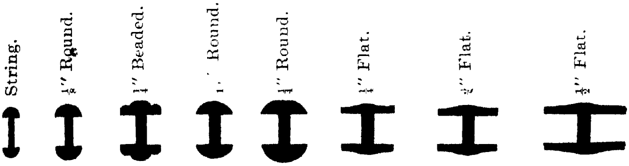


FIG. 26.—Fret Leads.

The outer flange is called the "leaf" of the lead, and the central portion the "heart". The heart is made of varying widths, according to the thickness of the glass it is to hold. It varies from a sixteenth to a quarter of an inch in depth. This lead is always in a more or less crippled state, but is easily made straight again for working purposes. Turn about an inch of it down at right angles and place on the floor, grasping the upper end of the calme with a pair of pliers and giving it a good pull. By this means the calme becomes beautifully straight, and should be laid flat along the work board for cutting into suitable lengths as the glazing proceeds.

It is usual to commence leading a figure panel by placing a lead completely round the head, which should then be laid in its exact position on the cutline, and there fastened by a few nails driven all round close against the lead, so as to hold the head firmly in position. The next piece of glass forming part of the body which comes into juxtaposition with the head is next fixed and placed in the outer flange of the lead surrounding the head. The fitting of the glass is done by placing a section of glass as nearly into its position in the lead as possible, and then with a piece of French chalk or lead pencil scribing round the flange of the lead. Remove the piece and examine the mark, and where the glass does not accurately fit the lead it must be grozed, or nipped away with the pliers, until an exact fit is obtained. Then surround that piece of glass with a lead, and so add piece to piece, gradually building up the panel until the whole of the glass is put together, every portion in its exact place. If one piece is allowed to work too full it will throw all the others out of range, and spoil the whole panel.

In leading-up canopy work even greater care must be exercised than with figure work, as all the lines painted upon one piece of glass must range with those painted upon the next piece, or very bad work will be the result.

Divisions.—It is usual, for ease and safety in handling, to make a "light" or window panel in sections not exceeding three feet in length, and the position of the divisions must be marked on the cutline.

It is obvious that in placing these sections together in the actual fixing of the window that provision must be made for keeping the rain and wind out just where they join.

This is got over by simply placing a half-inch lead on the bottom of each section, and a quarter-inch lead on the top of each.

The flange of the quarter-inch lead should be neatly laid down or flattened, so that in fixing the broad lead has only to be opened with the lathekin and "straddled" or "married" over the narrow one to produce a water and wind tight joint.

We will now suppose our "light" has been leaded; the next thing is to solder the joints.

Soldering.—This process is extremely simple, yet it often proves a difficult task to beginners. This is usually because they cannot get a "face" or tinned surface on the copper bolt or "bit," as it is technically termed. Let us see how it is done. Take your soldering iron and carefully file the copper bit flat and circular, so as to expose a surface about three-eighths of an inch in diameter; then have ready an old sardine tin, one that has been carefully cleaned from all grease, and a little bit of resin as large as a pea. Place the resin in the tin, and having brought the soldering iron to the requisite heat, place the hot "bit" on the resin, which will immediately melt, and rub it vigorously on the tin. This will have the effect of "tinning" the surface of the bit and making it ready to solder with.

Before beginning the actual soldering every joint must be rubbed with a composite candle; wax or stearine will be useless. They are called plumbers' dips, and are only kept by a few oilmen.

If composite candle cannot be obtained, powdered resin must be the alternative. The solder used is known as "blowpipe" solder, and is made in very thin strips or "straps".

Holding a strap of solder in the left hand, and the soldering iron in the right, every joint must be neatly and flatly coated with solder, so as to hold all the parts firmly together, and render them not a collection of separate pieces without adherent strength, but a single panel firm and strong to withstand gales and rainstorms.

The "bit" should be just hot enough to melt the solder and make it flow evenly over the joint. If it is too hot it will melt the lead, but if it is too cool the solder will be applied in gouty, unsightly patches. The joints should be well covered and strong, but should be fairly flat, not put on so as to represent "split-peas" or ugly little nubbles.

For the constancy of heat there is nothing to equal a gas iron, the heat of which, by a turn of the tap, can be regulated to a nicety, so that when once heated a workman may go ahead without stopping for an instant, until the whole panel is finished.

Work for Beginners.

To become used to the handling of the lead and tools, it would be as well if the beginner tried his unaccustomed hand at a simple "square" or "quarry" panel, with a coloured line and white outer margin round.

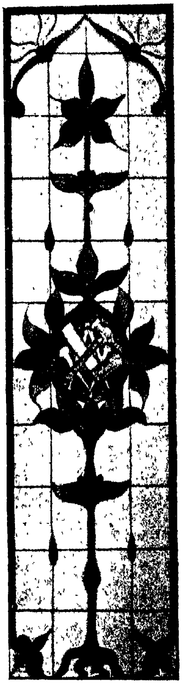


Fig. 27.—Design for a Masonic Panel.

For a panel of squares it will be best to nail a lath down along the inner edge of the coloured line. Against this lay a lead the whole length of the panel, and, commencing on the left, a row of squares may be laid with a strip of lead between each, the flanges clipping the glass on either side of it. Care must be taken to cut each of these dividing leads a trifle less than the width of each square, so that when a long lead is laid along the outer edge of all these squares to bind them it may fit closely over the glass, and not be thrust out of place by projecting short leads. Now, with a row of squares and a long binding lead alternately, "lead" the whole of the squares, which being done put a lead all round the panel, and hold the three sides you are not working upon with laths firmly nailed around them.

Next, strip by strip, add your coloured line; then a binding lead all round again, held in place with the laths; then the outer margin is to be added in the same way. The whole is then "bound" or finished off with a three-eighth or half-inch outer lead, and the whole of the joints neatly soldered.

A "quarry" panel may next be undertaken. A "quarry" is the old term for a diamond pane. With the outline upon the work board tack down a lath just inside the coloured line as in the "square panel" to bound the length of the light, another at right angles to bound the foot of the light. Commence at the left-hand corner of the light with a "long" and a "short" half square, and lay a lead along their edges, which should be clipped by the flange. The next row, running diagonally, would consist of a short half, a whole quarry, another whole quarry, and a long half. Against these place another long lead, and so proceed, row by row, diagonally, until all the quarries are in place. They should be tapped up with a lath now and again to keep the lines straight and true. The quarries are bound all round with a lead, and the coloured border and outer margin added as in the first panel, after which the joints are to be soldered in the same way, and the quarry light is complete.

Having become conversant with the nature of the lead, the handling of the tools, and the *modus operandi* of the work, more intricate patterns may be attempted, a few of which are here given, showing successive stages of difficulty. It will be noticed that Figs. 30, 33 and 34 contain a little painted work of a simple type for beginners.

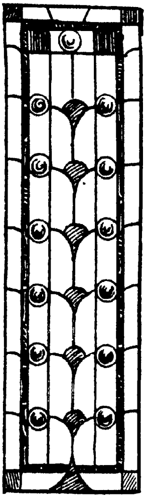


Fig. 28.

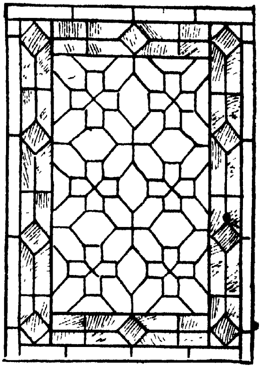


Fig. 29.

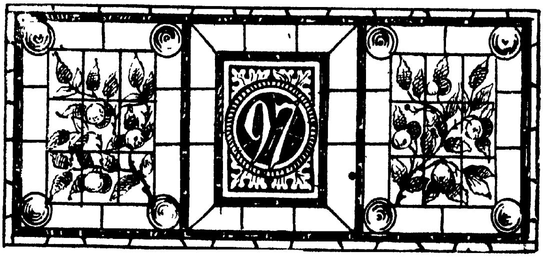


Fig. 30.

In glazing many little dodges may be learnt or invented which will facilitate the work.

When the glass does not quite fit the lead, breathe upon it as it lies in position on the cutline, dab the pounce bag over it where it is thrust into the lead, and run a piece of pointed stick round close to the flange of the lead. This

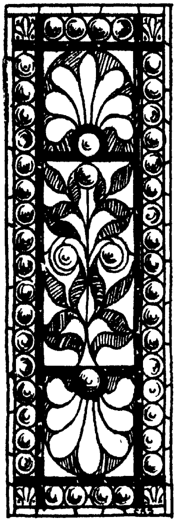


FIG. 31.

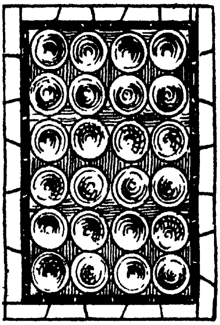


FIG. 32.

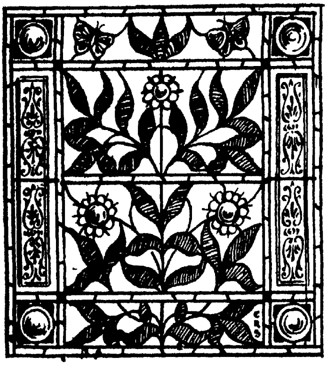


FIG. 33.

will show clearly, when the glass is lifted, where part must be grozed away to make it fit. A piece of old wire "carding cloth" is very useful to rub over tarnished lead, to make it take the solder easily. Sal ammoniac may take the place of resin for facing the copper "bit".

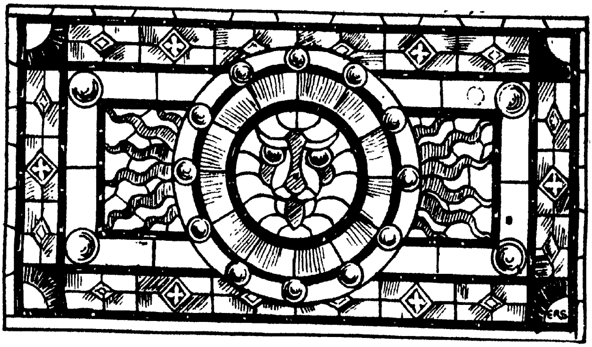


FIG. 34.

For leading circles or roundels a circle turning block should be used. It is simply a block of hard wood turned into cylinders of different diameters, round which a calme of

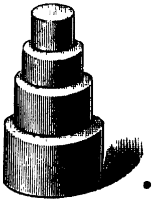


FIG. 35.—Turning Block.

lead can be wrapped so that each circle is of the size required. When the whole calme is wound round into a spiral it must be removed and stood on end; then with a careful downward cut the circles may be divided, and fall apart ready for adjusting round the discs of glass.

Where a great deal of circular work has to be cut a circle board is used as described under "Cutting," but where simple curves are required, as lines round a circular medallion, a makeshift may be made with a brad-awl and a piece of flat wood. Notches should be cut out of the edge of the wood, at the distance apart required for the width of the curves of glass, and the radius regulated by the position of a brad-awl, as shown in the illustration.

After our panels of glass, whether they be painted or plain work, are "soldered off" on both sides, there still remains an important process, without which our work would not be of any service when fixed, as it would let in both wind and rain—it must be rendered wind and water tight by cementing.

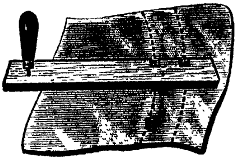


FIG. 36.—Circular Gauge.

Cementing.—Take a large earthenware paint pot, one that will hold about two quarts, and in it pour half a pint of turpentine, a pint of boiled oil, half a packet of lamp black, and two ounces of red lead. Crush a couple of balls of dry whiting and pass it through a sieve, adding it, little by little, to the ingredients in the pot, stirring it meantime with a strong stick until a thick mixture is produced, so thick that the stick will stand upright in it. This is the cement.

Lay a light down flat on the work board, and using a stumpy, house painter's brush, rub the cement well in under the leads, going over them again and again in every direction until no more can be forced under the flanges.

Have ready a vessel of sifted cinder-ash, and mix with it an equal bulk of powdered whiting. Strew this liberally over the panel, and with pads of hay rub off all the cement adhering to the surface. The cinder-ash and whiting act as an absorbent and suck the oil from the cement under the leads.

Dust a little whiting over the panel, then, turning it over, repeat the process of cementing.

Stand the panel aside for a couple of hours, during which the cement under the leads will to some extent become firm, then, with a pointed stick of hard wood, go round every piece of glass close to the lead, and remove all the cement that has oozed out.

Finally, with hard scrubbing brushes polish up both glass and leads, and the panel is finished; but it should be stood aside for a day or two for the cement to harden before fixing.

To clean off the cement, saw-dust, marble mason's dust, plaster of Paris, or fine sand and whiting are all good.

Banding.—This is the last process of all, and consists of fastening on pieces of copper wire to certain parts of the panels for fixing purposes.

Wherever it has been arranged for the iron bars to be placed, which hold the glass panels into the stonework, there must a row of copper tie-bands be soldered on.

Of course, where division leads have been placed in a "light," so as to divide it into sections, there must necessarily be an iron bar (called a saddle-bar), and it is also usual to place a bar as near as possible midway between the division bars, so as to have bars all up the window at intervals of from twelve to sixteen inches.

Where there are "divisions," "half bands" must be soldered on—that is, pieces of No. 17 gauge copper wire cut off about two and a half inches in length, one end being turned into a little "eye" for the solder to hold the more securely.

Where bars are to run across the window between the division bars, "straight bands' must be soldered on. These are simply straight pieces of copper wire about three and a half inches in length.

It must be noted that "tie-bands" must always be soldered to a "joint"—a solder-joint in the leading—and never, if avoidable, to the lead itself. A solder-joint is a strong part, and, therefore, the bands should there find a holding place.

The copper wire should be rubbed clean and bright with glass paper before it is cut into lengths.

Spirit of salts should be the medium used for soldering on the "ties"—not candle, as ties so soldered are very apt to fall off.

Saddle-bars.—These are for fixing the lights, and for ordinary church work we should recommend half-inch round bars. A number of architects use square bars, but this is a mistake, for this reason: A round bar seen from any position never appears more than its diameter—that is to say, a half-inch round bar cannot show wider than half an inch, whereas a half-inch square bar when seen from below often shows its diagonal size of about three-quarters of an inch, and so appears clumsy, and is apt to cut off finger tips or other important parts. Again, copper tie-bands are apt after many years to corrode and break where they touch the iron bars. With round bars they only touch at one place, frequently circle the bar without touching, and being bent circularly present no weak angles to break. On the other hand, the copper wire being bent in sharp angles to embrace the square bar is weakened at the angles, and there gives way first. The bars should be painted with red lead and boiled oil before being fixed, to prevent rusting.

FINAL NOTE.

We have taken the reader through every stage in the production of a stained glass window, from its inception to its final stage of banding, and, as he will have seen, there is no "mystery" in any part of it any more than there is in any other branch of art. The only mysteries in the attainment of proficiency in painting, style, depth, breadth and colouring are patience and perseverance—two essentials which are the "open sesame" of every art under the sun, and without which no artist, however clever he may be, will ever attain the front rank in the art of glass painting.

DIRECTOR OF INDUSTRIES
LIBRARY
4-SEP 1923
BENGAL.